MOTOROLA INC.

AVAILABLE BACKGROUND REFERENCE PUBLICATIONS

Seven reference publications are available to provide background information needed to service some of the newer Motorola products more effectively. The information in these publications is not duplicated in our instruction manuals. To obtain your free copy, check the ones you want and return this self-mailer to us.

Check item desired:

☐ **Basic Logic Circuit Guide** 68P81105E88
Describes the basic logic circuits used in Motorola Communications digital equipment and the logic notational scheme used in our instruction manuals.

☐ **"Digital Private-Line" Binary-Coded Squelch** 68P81106E83
Contains fundamentals of "Digital Private-Line" system operation, circuit operation and servicing techniques.

☐ **Safe Handling of CMOS Integrated Circuit Devices** 68P81106E84
Describes special handling techniques needed to prevent irrepairable damage from static charges encountered with normal handling of CMOS devices.

☐ **Reducing Noise Interference in Mobile Two-Way Radio Installations** 68P81109E33
Defines the major sources of noise encountered in a mobile radio installation and suggests methods of remedying them.

☐ **Anti-Skid Braking Precautions** 68P81109E34
Provides installation suggestions and a detailed checkout procedure for installation of mobile radios in vehicles with anti-skid braking systems.

☐ **Removal and Replacement of Chip Components on Circuit Boards** 68P81113E77
Contains general information and repair procedures relative to chip-type (leadless) components.

☐ **Lightning Protection Recommendations** 68P81111E17
Provides general information concerning lightning protection for equipment sites. Also, provides a quick reference of available lightning protection kits.

68P81028E93-I

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MOTOROLA

NUCLEUS™ PAGING STATION

USER'S GUIDE

Table of Contents

GLOBAL PAGING INFRASTRUCTURE DIVISION
1301 E. Algonquin Road, Schaumburg, IL 60196

68P81000F10–K
9/9/94-PHI

OPERATION

MAINTENANCE & TROUBLESHOOTING

INDEX OF CONTROL FRONT PANEL MENUS

FOREWORD

Scope of Manual

This manual is intended for use by experienced technicians familiar with similar types of equipment. It contains all user information required for the equipment described and is current as of the printing date. Changes which occur after the printing date are described by Service Manual Revisions (SMRs). These SMRs are placed in the pocket in the back of the manual.

Service

Motorola's National Service Organization offers one of the finest nationwide installation and maintenance programs available to commercial equipment users. This organization includes approximately 800 authorized Motorola Service Stations (MSS) located throughout the United States, each manned by FCC-licensed technicians.

These MSSs are independently owned and operated and were selected by Motorola to service its customers. Motorola maintenance is available on either a time and material basis or on a periodic fixed-fee type arrangement.

Should you wish to purchase a service contract for your Motorola equipment, contact your Motorola Service Representative, or write to:

Global System Support Services
Attention: M. Gard
Motorola Communications and Electronics, Inc.
1301 E. Algonquin Road
Schaumburg, IL 60196

Motorola Paging One-Call Support

We hope this manual is helpful in answering your questions about the product. Should you have additional questions, please contact your Motorola salesperson or our telephone "help" line. The Motorola Paging One-Call Support line is available 24 hours a day, 365 days a year.

- Within the United States, please call **(800) 520-7243.**
- Outside the United States, please call **(817) 231-7069.**

In addition to the help line, Motorola regularly offers technical training sessions on our products from our Ft. Worth, Texas facility. A complete list of courses is available by calling the help line.

REPLACEMENT PARTS ORDERING

ORDERING INFORMATION

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Crystal and channel element orders should specify the crystal or channel element type number, crystal and carrier frequency, and the model number in which the part is used.

Orders for active filters, Vibrasender and Vibraspondor resonant reeds should specify type number and frequency, should identify the owner/operator of the communications system in which these items are to be used; and should include any serial numbers stamped on the components being replaced.

MAIL ORDERS

Send written orders to the following addresses:

Replacement Parts/Test Equipment/
Crystal Service Items:

Motorola, Inc.
Worldwide System and
Aftermarket Products Division
Attention: Order Processing
1313 E. Algonquin Road
Schaumburg, IL 60196

International Orders:

Motorola, Inc.
Worldwide System and
Aftermarket Products Division
Attention: International Order Processing
1313 E. Algonquin Road
Schaumburg, IL 60196

Any Other Orders:

Motorola, Inc.
Attention: Global Paging
Infrastructure Sales
5555 N. Beach Street
Ft. Worth, TX 76137

TELEPHONE ORDERS

Replacement Parts/Test Equipment/
Crystal Service Items:

CALL: (800) 422-4210 (Domestic)
(800) 826-1913 (Federal Government Orders)

National Service Training
FAST Video Tapes

CALL: (708) 576-8012

TELEFAX ORDERS

Replacement Parts/ Test Equipment/
Crystal Service Items:

Telex: 280127; FAX: (708) 576-6285 (Domestic)
403305 MOTOPARTS SHBU UD (International)

CUSTOMER SERVICE FOR REPLACEMENT PARTS

Replacement Parts/Test Equipment/Crystals:
Parts Customer Service/Product Customer Service
CALL: (800) 422-4210

Parts Identification:
CALL: (708) 538-0021

GENERAL SAFETY INFORMATION

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic energy safety standard which applies to the use of this equipment. Proper use of this radio will result in exposure below the OSHA limit. The following precautions are recommended:

- ***Do not*** operate the transmitter of a fixed radio (base station, microwave and rural telephone rf equipment) or marine rado when someone is within two feet (0.6 meter) of the antenna.

- ***Do not*** operate the transmitter of any radio unless all rf connectors are secure and any open connectors are properly terminated.

In addition,

- ***Do not*** operate this equipment near electrical caps or in an explosive atmosphere.

- All equipment must be properly grounded according to Motorola installation instructions for safe operation.

- All equipment should be serviced only by a qualified technician.

Refer to the appropriate section of the product service manual for additional pertinent safety information.

MODELS AND OPTIONS

Nucleus Paging Station Models

Model Number and Description	
T5481	Standard Power Station (20, 25, 100, or 125 W)
T5482	High Power Station (300 or 350 W)

Nucleus Paging Station Options

Option Category	Option Number and Description	
Transmit Frequency/ Power Output	**X330**	VHF, 25 W
	X195	VHF, 125 W
	X830	VHF, 350 W
	X213	280 MHz, 125 W
	X214	280 MHz, 300 W
	X260	900 MHz, 20 W
	X660	900 MHz, 100 W
	X201	900 MHz, 300 W
Power Supply	**X115**	625 W AC Power Supply (90–280 V ac, 47–63 Hz)
	X30	625 W AC Power Supply with Battery Revert (Control Only)
	X43	625 W AC Power Supply with Battery Revert (Station Power)
	X342	625 W DC Power Supply (Input Voltage 21–34.5 V dc)
	X581	625 W DC Power Supply (Input Voltage 41–72 V dc)
Control	**X151**	Remote Control C-NET/Internal NIU (must also order X158)
	X158	*Nucleus* Station Control Module (SCM)
	X621	External Control (SCM with Wildcard I/O Board; no Internal NIU)
Reference Module/ Frequency Stability	**X576**	Reference Module with GPS Receiver
	X206	Reference Module with Ultra High Stability Oscillator (5 ppb)
	X208	Reference Module with High Stability Oscillator (30 ppb)
	X212	External Frequency Stability *(no Reference Module)*
Cabinet	**X92**	25″ Cabinet
	X93	25″ Cabinet with Cable I/O in Rear Door
	X308	46″ Cabinet
	X311	46″ Cabinet with Cable I/O in Rear Door
	X36	70″ Cabinet
	X307	2-meter Cabinet
	X362	Packing Kit for Station without Cabinet
RF	**X371**	Antenna Relay
	X676	Triple Circulator (add two circulators)
	X677	Double Circulator (add one circulator)
Internal NIU Modems	**X437**	Dial Modem (PSTN) for Internal NIU
	X443	Link Modem (QAM) for Internal NIU
Receiver Module	**X333**	Link Receiver VHF (specific band must be specified)
	X334	Link Receiver UHF (specific band must be specified)
	X336	Link Receiver 900 MHz (specific band must be specified)
	X662	Monitor Receiver VHF (specific band must be specified)
	X632	Monitor Receiver UHF (specific band must be specified)
	X630	Monitor Receiver 900 MHz (specific band must be specified)

PERFORMANCE SPECIFICATIONS

AVAILABLE MODELS

						Power Consumption (varies with options)			
Frequency (MHz)	Power Output (with Standard Single Circulator)	Chassis Model & Frequency Option	Station Dimensions (Rack Mount) (H x W x D)	Station Weight	FCC Type Acceptance	Operating State	AC Power 120 V 60 Hz	AC with Battery Revert (24 V)	DC Power ±48/60 V
132–154 150–174	25 W (variable to 5 W)	T5481 (with X330)	8.75 x 19 x 20 in. 23 x 48 x 51 cm	60 lbs. 27 kg	ABZ89FC3781	Transmit Standby	170 W 66 W	150 W 66 W	160 W 77 W
132–154 150–174	125 W (variable to 20 W)	T5481 (with X195)	8.75 x 19 x 20 in. 23 x 48 x 51 cm	60 lbs. 27 kg	ABZ89FC3783	Transmit Standby	472 W 66 W	422 W 66 W	525 W 77 W
132–146 144–154 150–160 157–174	350 W (variable to 100 W)	T5482 (with X830)	14 x 19 x 20 in. 35 x 48 x 51 cm	105 lbs. 48 kg	ABZ89FC3782	Transmit Standby	1180 W 133 W	n/a n/a	1270 W 85 W
276–284	125 W (variable to 20 W)	T5481 (with X213)	8.75 x 19 x 20 in. 23 x 48 x 51 cm	60 lbs. 27 kg	*Non-US sales only*	Transmit Standby	540 W 66 W	500 W 66 W	515 W 77 W
276–284	300 W (variable to 100 W)	T5482 (with X214)	14 x 19 x 20 in. 36 x 48 x 51 cm	105 lbs. 48 kg	*Non-US sales only*	Transmit Standby	1245 W 133 W	n/a n/a	1200 W 89 W
928–944	20 W (variable to 5 W)	T5481 (with X260)	8.75 x 19 x 20 in. 23 x 48 x 51 cm	55 lbs. 25 kg	ABZ89FC5764	Transmit Standby	170 W 66 W	150 W 66 W	160 W 77 W
928–944	100 W (variable to 20 W)	T5481 (with X660)	8.75 x 19 x 20 in. 23 x 48 x 51 cm	60 lbs. 27 kg	ABZ89FC5766	Transmit Standby	593 W 66 W	550 W 66 W	605 W 77 W
928–944	300 W (variable to 100 W)	T5482 (with X201)	14 x 19 x 20 in. 36 x 48 x 51 cm	105 lbs. 48 kg	ABZ89FC5765	Transmit Standby	1546 W 133 W	n/a n/a	1422 W 89 W

GENERAL INFORMATION

INPUT POWER	
Power Supply Type	Switching
AC Power Voltage Frequency Battery Revert	 90–280 V ac, line-sensing 47–63 Hz, line-sensing 24 V dc
DC Power	±24 V dc (21–34.5 V dc, 40 A max.) ±48/60 V dc (41–72 V dc, 18 A max.)
TX FREQUENCY (transmit bandwidth varies by model)	
Frequency Generation	Synthesized – No multiplier stages
Channel Spacing	25 kHz standard/ 12.5 kHz special applications
Multiple Channel Capability	32
Conducted Spurious and Harmonic Emissions	Better than –90 dBc
Adjacent Channel Noise	Better than –70 dBc
Frequency Deviation (2-level)	±5000 Hz, programmable in 1 Hz steps
Frequency Deviation (4-level)	Per ERMES and FLEX™ specifications
Frequency Offsets	±5000 Hz, programmable in 1 Hz steps
Frequency Stability Ultra High Stability Oscillator High Stability Oscillator Non-Simulcast Oscillator C-NET Frequency Reference External Reference	 ±0.005 ppm –30°C to +60°C ±0.03 ppm –30°C to +60°C ±1 ppm –30°C to +60°C ±0.03 ppm –30°C to +60°C Consult Systems Engineering
FM Hum & Noise	VHF; –50 dB (300–3000 Hz Bandwidth) 280 MHz; –50 dB (300–3000 Hz Bandwidth) 900 MHz: –45 dB (300–3000 Hz Bandwidth)
Isolation	20 dB (Standard Single Circulator) 40 dB (Option X677 Double Circulator – adds single circulator) 60 dB (Option X676 Triple Circulator – adds double circulator – 900 MHz only)
TX MODULATION	
Pager Signalling	2-level and/or 4-level binary FSK-NRZ including GSC, POCSAG, ERMES, & FLEX™ codes
Modulator	DSP-based
Maximum Paging Data Rates	2-level: 2400 or 3200 bps; 4-level: 6400 bps
Modulation Rise Time	2-level: 88/140/250 µs selectable 4-level (and 2-level 3200 bps FLEX™): 88 µs fixed
FCC Emissions Designators	VHF, 900 MHz: 16KOF1D
TX OUTPUT POWER	
Power Output	Continuous duty and selectable by front panel on a per-channel basis.
Antenna Connector	Type "N" (50 ohms output impedance)
CONTROL	
Remote System Control	C-NET
ENVIRONMENTAL	
Operating Temperature: Operating Humidity:	–30°C to +60°C (–22°F to +140°F) 0 to 95% relative @ 50°C

AVAILABLE LINK AND MONITOR RECEIVERS

	MB (External)	VHF (Internal)	UHF (Internal)	900 MHz (Internal)
Frequency (MHz)	72–76	132–154 150–174	403–433 438–470 470–494 494–520	922–941 941–960
Link Option	C661	X333	X334	X336
Monitor Option		X662	X632	X630
Channel Spacing	20 kHz	25 kHz	25 kHz	12.5/25 kHz
Frequency Stability	±5.0 ppm	Same as transmitter		
Signal Displacement Bandwidth	±2 kHz minimum			
Sensitivity (12 dB SINAD)	0.35 µV	0.25 µV	0.35 µV	0.35 µV
Sensitivity (20 dB quieting)	0.50 µV	0.35 µV	0.50 µV	0.50 µV
Adjacent Channel Rejection:	90 dB	85 dB	85 dB	70/75 dB
Intermodulation	75 dB	85 dB	85 dB	80 dB
Spurious & Image Rejection	90 dB	95 dB		
Audio Response	Front panel switchable: Flat or EIA Deemphasis			
Flat Audio ±1 dB	250 – 3000 Hz*	DC – 3000 Hz*		
Audio Out Level	–5 dBm (±2 dB) single-ended*			
Line Audio Level	Adjustable –30 to +11 dBm @ 600 ohms (with optional wireline module)			
FM Hum and Noise	–50 dB	–50 dB	–50 dB	–45/–50 dB

***NOTE:** Measured at signal "Link Rx Audio" or "Monitor Rx Audio", referenced to 1 kHz

CABINET OPTIONS

Option	Cabinet Dimensions (H x W x D)	Cabinet Weight	Maximum Number of Stations
X92	25 x 22 x 21.25 in. 64 x 56 x 54 cm	59 lbs. 27 kg	Two T5481 One T5482
X308	46 x 22 x 21.25 in. 117 x 56 x 54 cm	125 lbs. 57 kg	Four T5481 Two T5482
C307 (indoor)	70 x 23.8 x 21.5 in. 178 x 60 x 55 cm	200 lbs. 91 kg	Six T5481 Four T5482
X124 / X136 (outdoor)	70 x 23.8 x 21.5 in. 178 x 60 x 55 cm	235 lbs. 107 kg	Six T5481 Four T5482

ALL SPECIFICATIONS CONFORM TO TIA/EIA-603 TEST STANDARDS AND ARE GUARANTEED AT +25°C. SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

1 MOTOROLA PAGING SYSTEMS

The Motorola *Nucleus* Paging Station is one of the elements that make up a Motorola paging system using C-NET control (refer to Figure 1−1 through Figure 1−3):

- **Terminal**

  The terminal accepts paging requests via direct dial-up phone interface or via data entry equipment. It is connected to the controller for key requests, control handshakes, and to pass on pager addresses and information for transmission. Terminals maintain subscriber data and can provide paging traffic and billing data.

- **Control Point**

  The control point is responsible for recognizing paging requests from the the terminal and for keying the paging station. Using C-NET control, the control point consists of a Channel Interface Unit (CIU) and a Network Control Unit (NCU). The CIU provides the handshake with the terminal. The NCU provides overall control of the C-NET network, including the paging data stream sent to the paging station. The C-NET data stream includes paging data and control and timing information.

- **Communication Path**

  The C-NET data stream path from the control point to the paging station can be an rf link, a wireline link, or a satellite link. An rf link requires a link receiver at the paging station, while a satellite link requires a satellite downlink at the paging station.

- **Paging Station**

  The *Nucleus* Paging Station typically includes a Network Interface Unit (NIU), which decodes the C-NET data stream sent from the control point. The NIU converts the paging data into Synchronous Local Control (SYLC) format, and sends it to the Station Control Module (SCM) for processing. Then the data is converted into modulation and rf energy for transmission to the pager.

- **Monitor Receiver**

  The use of a monitor receiver depends on the type of system synchronization used:

  When using **Monitor Receiver Synchronization** (refer to Figure 1−1), the monitor receiver monitors the paging station transmissions for modulation characteristics. When misaligned modulation is detected, it is reported back to the control point by the dial-up phone line return path for corrective action.

  When using **Direct Synchronization with Digital Satellite Link** (refer to Figure 1−2), the monitor receiver is used for setup and diagnostics but not for synchronization.

  When using **GPS Synchronization (Self-Synchronization)** (refer to Figure 1−3), the monitor receiver is used for setup and diagnostics but not for synchronization.

- **Pager**

  The pager is a miniature radio receiver carried by the user for retrieval of information from the paging terminal. Pagers can provide the user with an alert, a voice transmission, a numeric display, or an alphanumeric display.

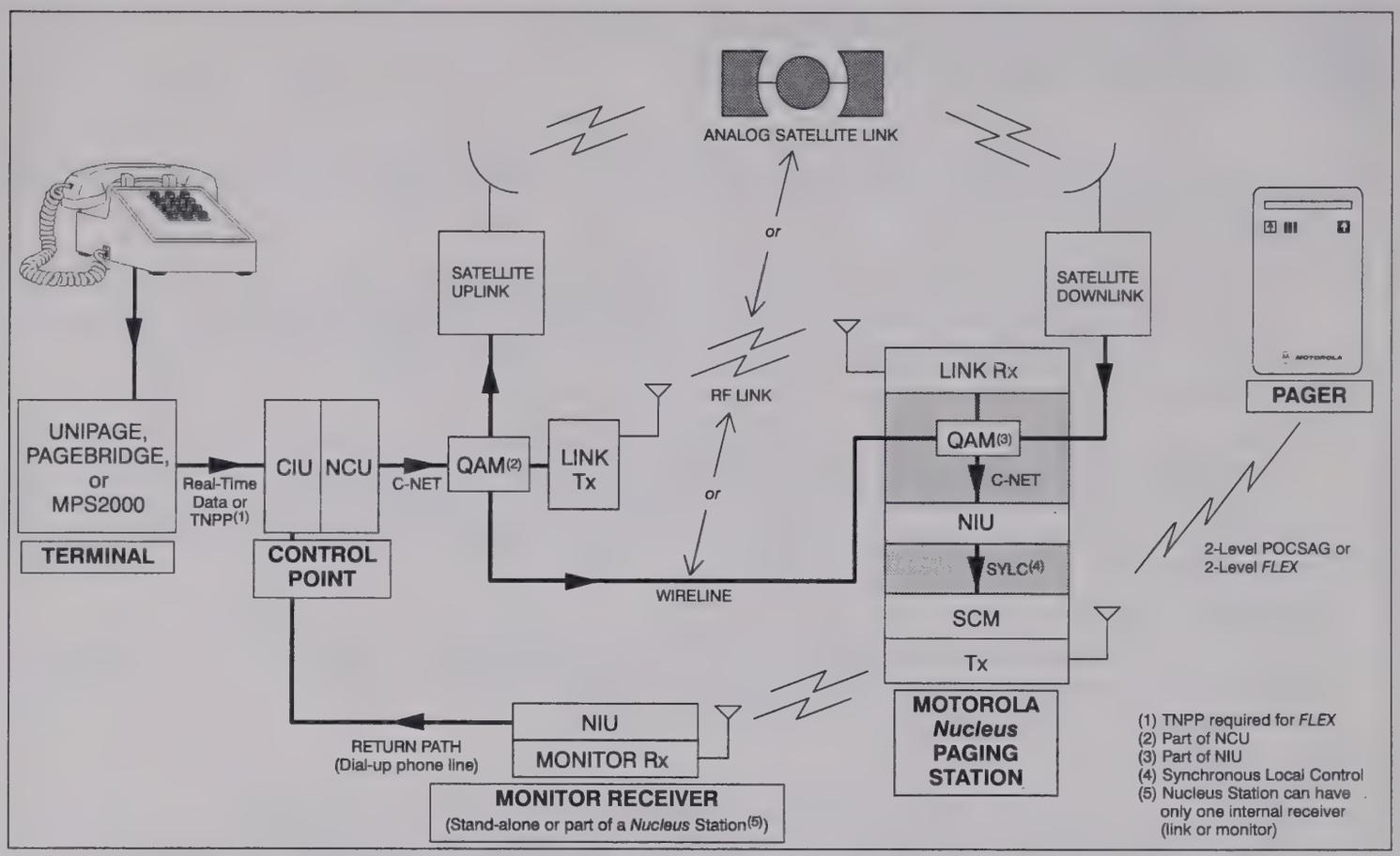


Figure 1–1. Nucleus *Paging System Block Diagram – Monitor Receiver Synchronization with C-NET*

Monitor Receiver Synchronization

A monitor receiver monitors paging station transmissions for modulation characteristics. When misaligned modulation is detected, it is reported back to the control point (CIU) by a dial-up phone line. The control point then takes corrective action to restore synchronization, using the C-NET data stream to make the necessary timing corrections to each paging station.

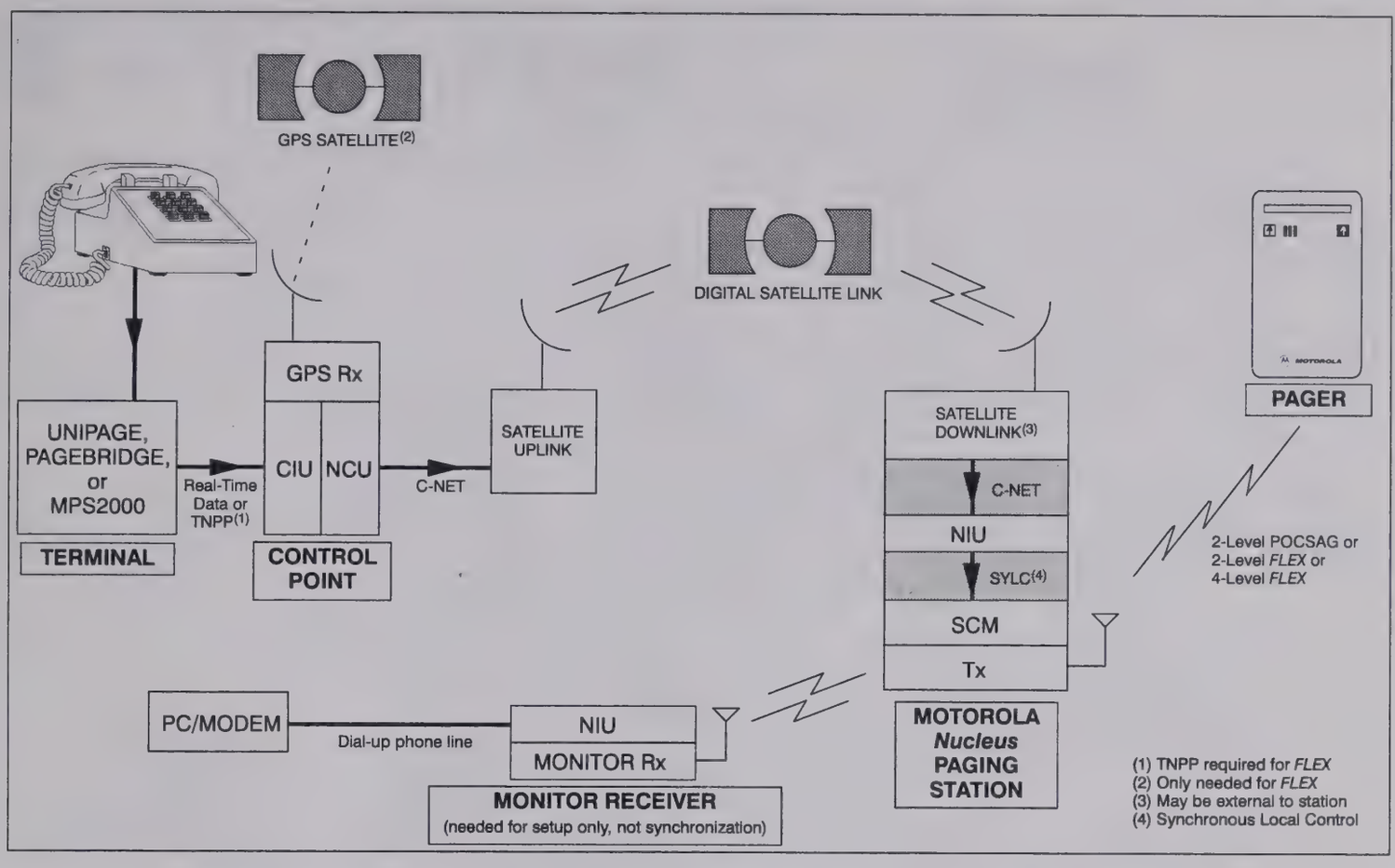


Figure 1–2. Nucleus *Paging System Block Diagram – Direct Synchronization via Digital Satellite Link with C-NET (Monitor Receiver not needed for synchronization)*

Direct Synchronization (with Digital Satellite Link)

A monitor receiver is used for setup and diagnostics but not for synchronization. Information from the monitoring NIU is acquired using a PC and modem. Delay values are entered once manually and synchronization is maintained by timing signals embedded in the C-NET data stream. The NIU in the paging station compares the C-NET data stream timing signals to the NIU reference oscillator, and generates a correction voltage which maintains synchronization between the two signals.

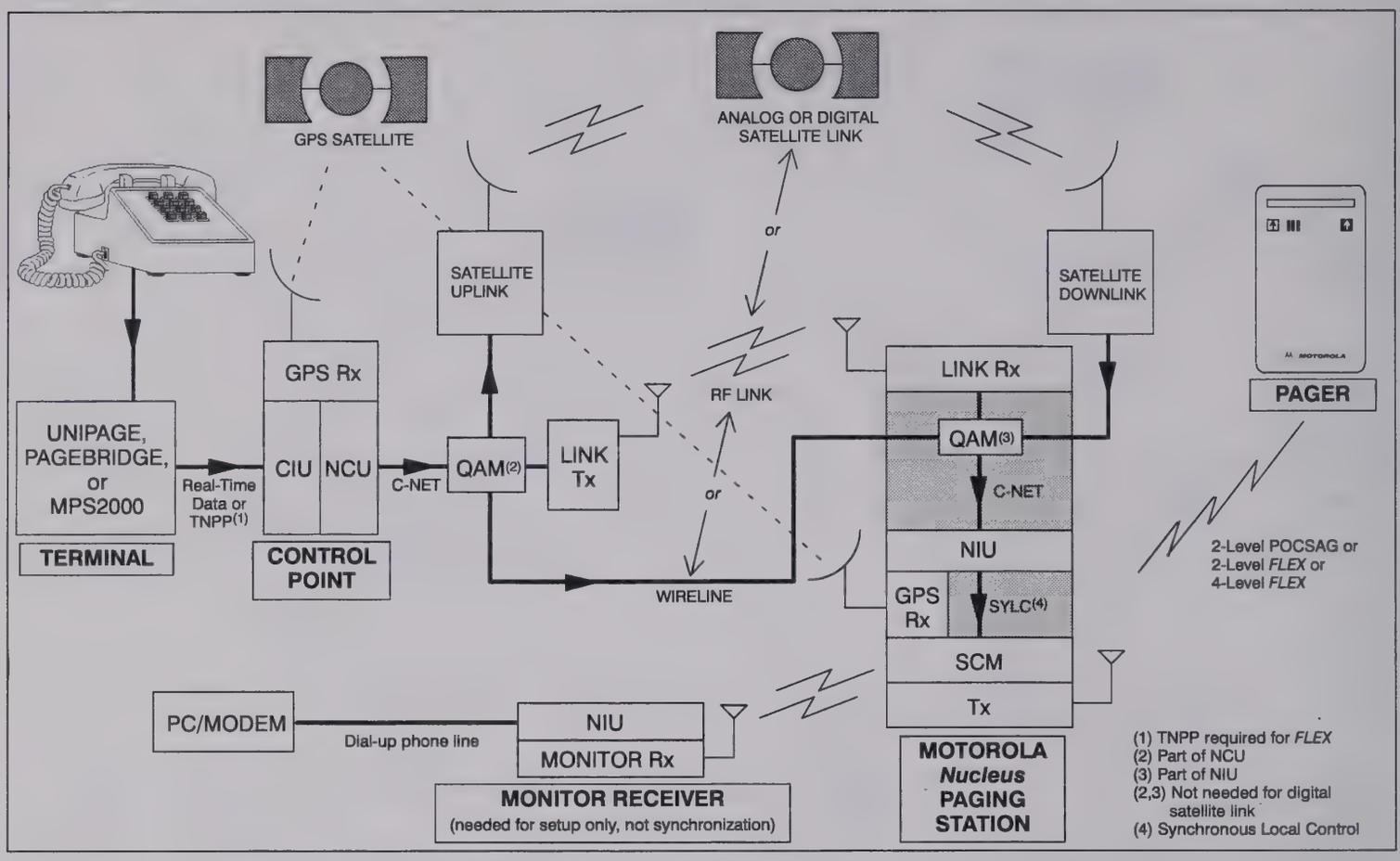


Figure 1–3. Nucleus *Paging System Block Diagram – GPS Synchronization (Self-Synchronization) with C-NET*

GPS Synchronization (Self-Synchronization)

A monitor receiver is used for setup and diagnostics but not for synchronization. Information from the monitoring NIU is acquired using a PC and modem. Delay values are entered once manually and synchronization is maintained by signals received from Global Positioning System (GPS) satellites. Both the paging station and the control point have GPS receivers.

2 *NUCLEUS* PAGING STATIONS

General Description

The *Nucleus* Paging Station offers many advanced features and capabilities. *Size is only the beginning:*

- **Reduced station size** – Size and weight are reduced dramatically compared to previous paging station designs. This is especially important when installing or maintaining stations in remote or difficult locations.
- **High-speed signalling capability** – All *Nucleus* Paging Stations are fully capable of 4-level modulation as specified both by Motorola's FLEX™ code and the European Radio Messaging System (ERMES). At the same time, your *Nucleus* station will continue to process 2-level modulation used by POCSAG pagers.
- **"Plug and play" installation and operation** – The Nucleus Paging Station is factory-aligned to a high degree of accuracy. No modulation alignment is required during installation, other than setting the desired Nominal Binary Deviation value. You save time and avoid expensive test equipment.

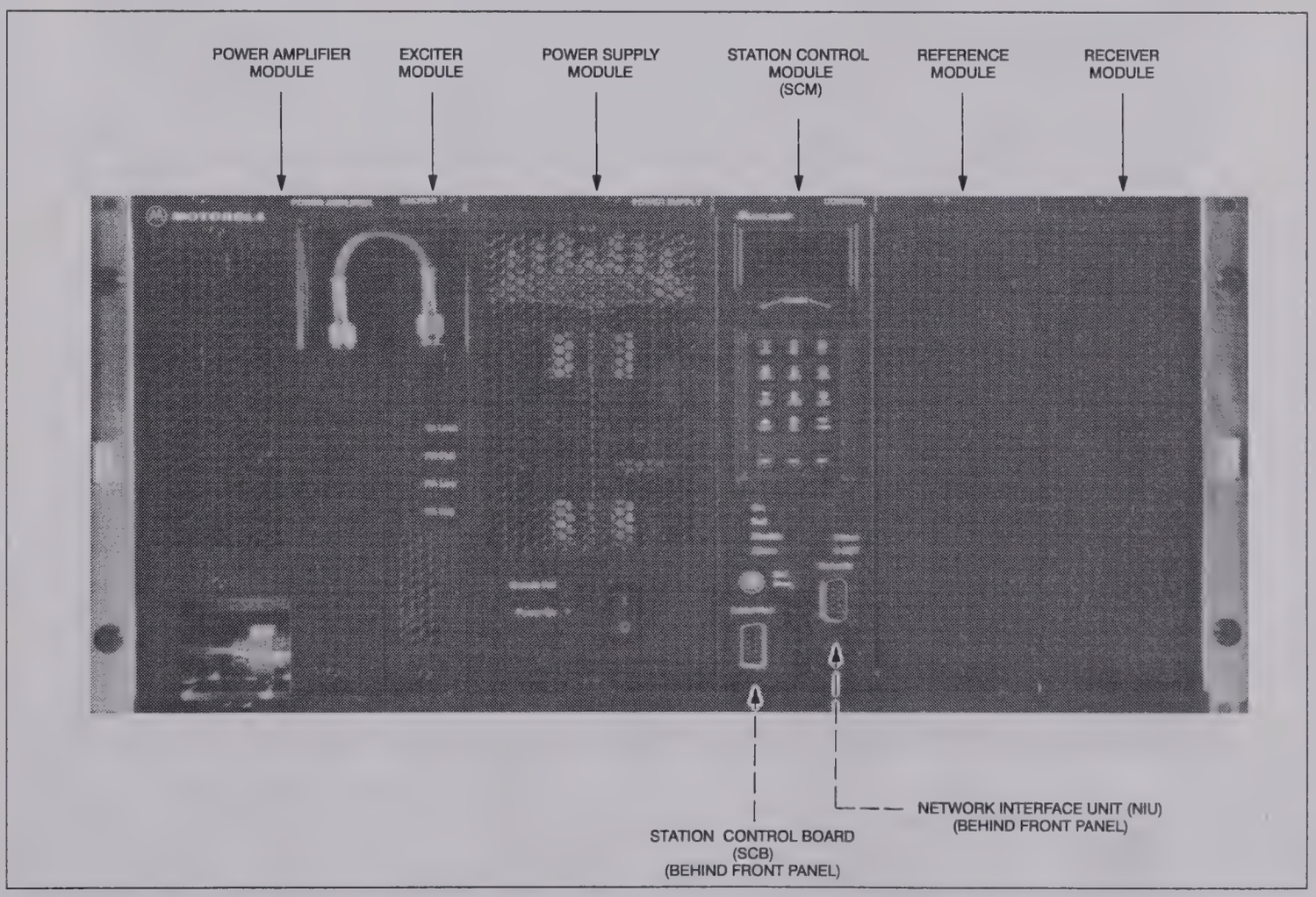


Figure 2–1. Nucleus *Standard Power (up to 125 W) Paging Station*

General Description (continued)

- **Modular design** – Each station module is considered a Field Replaceable Unit (FRU), which can be replaced or added while leaving the rest of the station intact. This minimizes downtime and reduces spare parts inventory and maintenance errors.
- **Field Replaceable Unit (FRU) diagnostics** – Station alarms and LED indicators are module-oriented for quicker troubleshooting.

For the locations of each module, refer to Figure 2–1 for standard power stations (up to 125 W), and to Figure 2–2 for high power stations (300 and 350 W).

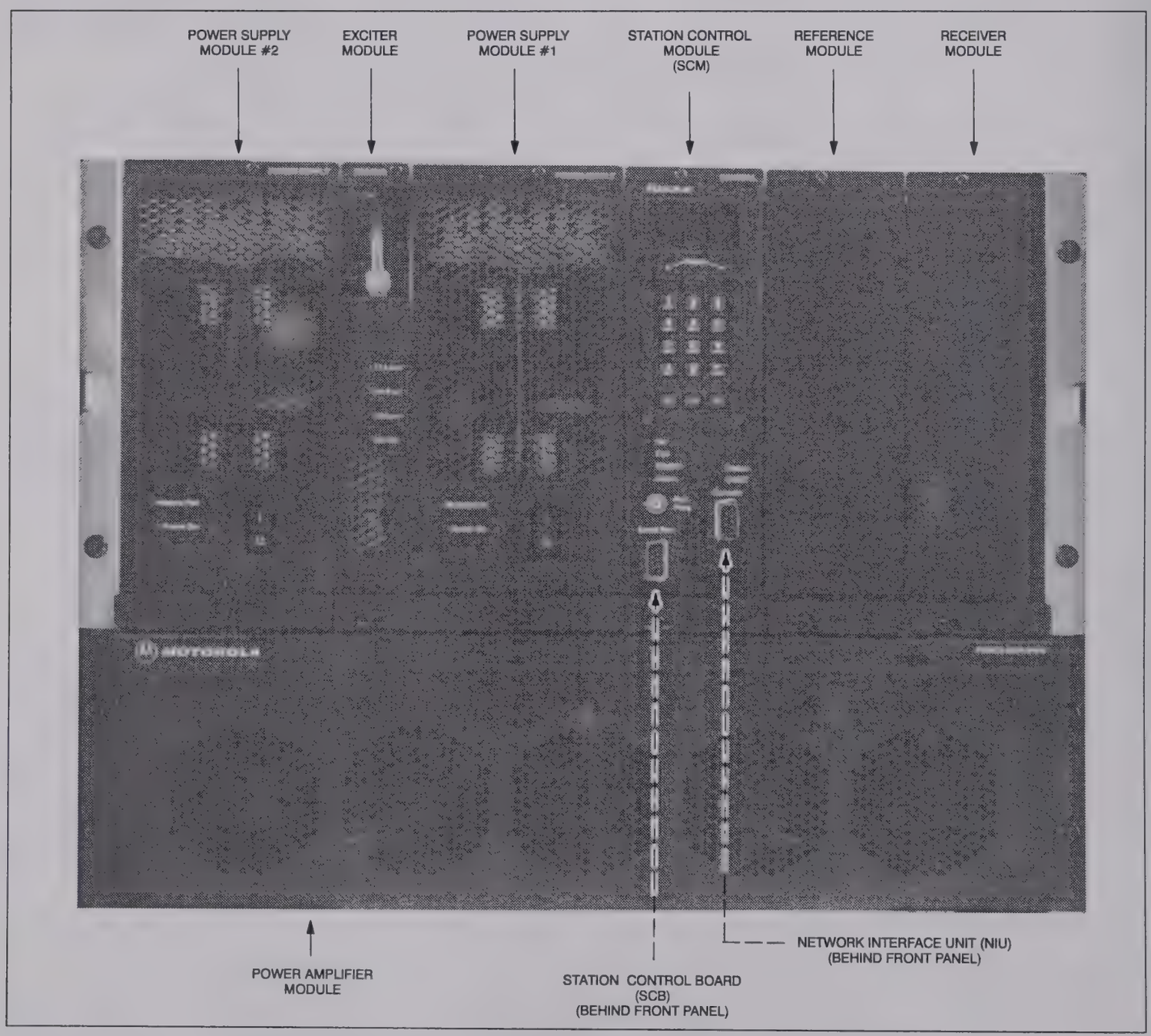
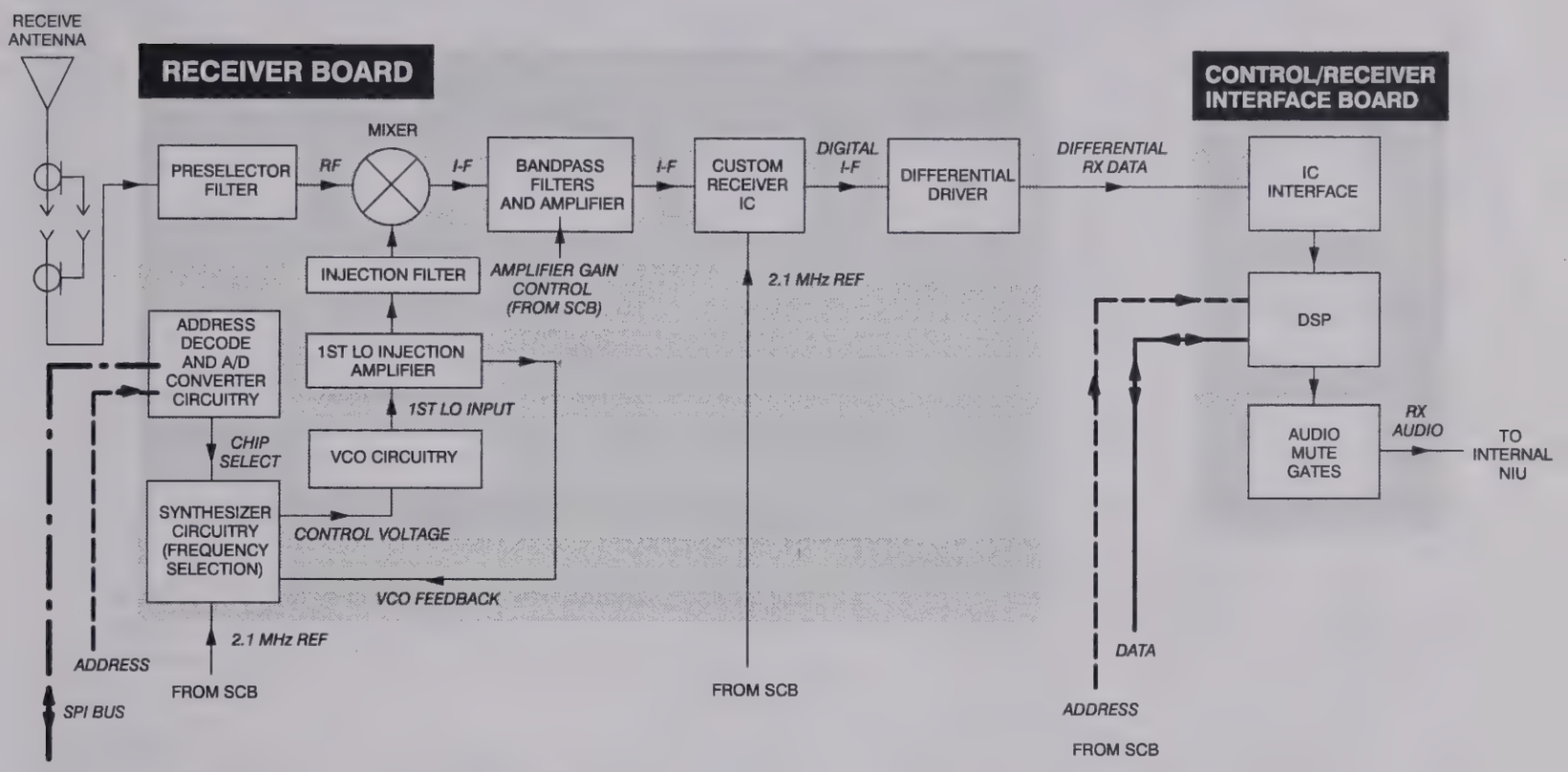


Figure 2–2. Nucleus *High Power (300 and 350 W) Paging Station*

Description of Modules

Each of the major elements of a typical *Nucleus* Paging Station is illustrated in block diagram form and described on this and the following pages. Paging data flow is from left to right along the top of each block diagram.



Receiver Module (Receiver Board and Control/Receiver Interface Board)

The optional Receiver Module consists of the Receiver Board (located behind the Receiver front panel on the right side of the *Nucleus* Paging Station), and the Control/Receiver Interface Board, which is a daughter board mounted on the Station Control Board (behind the Control front panel).

The Receiver Board accepts rf input from a receive antenna and performs bandpass filtering and dual down conversion on the signal. The custom receiver IC then converts the signal from analog to digital and outputs a differential data signal which is sent to the Control/Receiver Interface Board.

The Control/Receiver Interface Board takes the differential data signal and processes it into audio output, which is then sent to the Internal NIU.

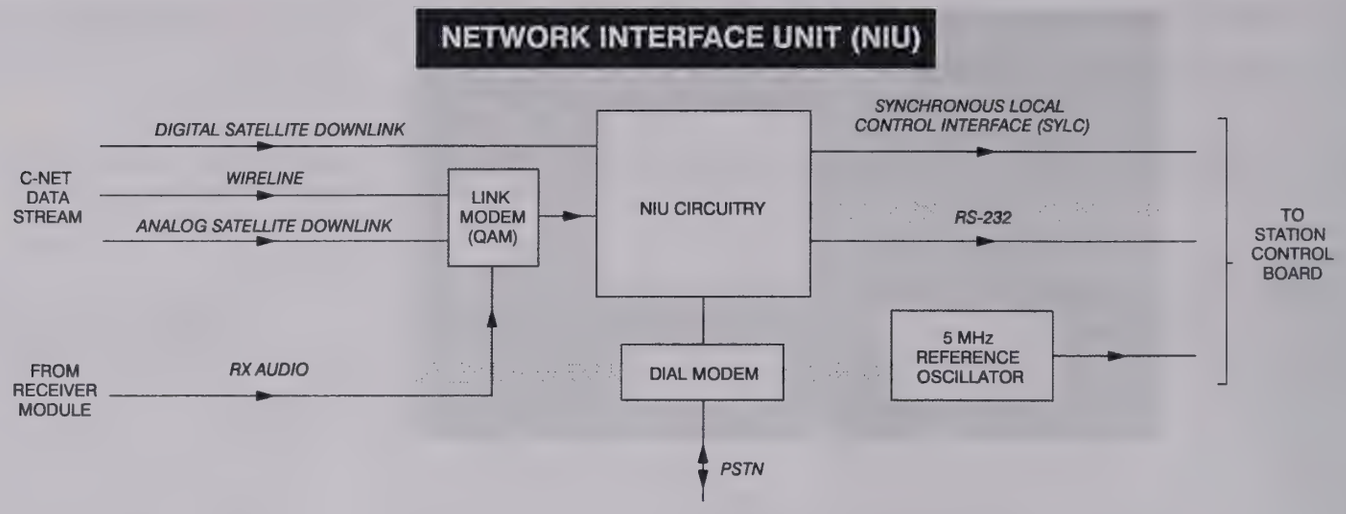
Using the Control front panel, you can configure the Receiver Module as either a link receiver or a monitor receiver.

Receiver Modules are available as follows:

VHF	132 to 154 MHz
"	150 to 174 MHz

UHF	403 to 433 MHz
"	438 to 470 MHz
"	470 to 494 MHz
"	494 to 520 MHz

900 MHz	922 to 941 MHz
"	941 to 960 MHz



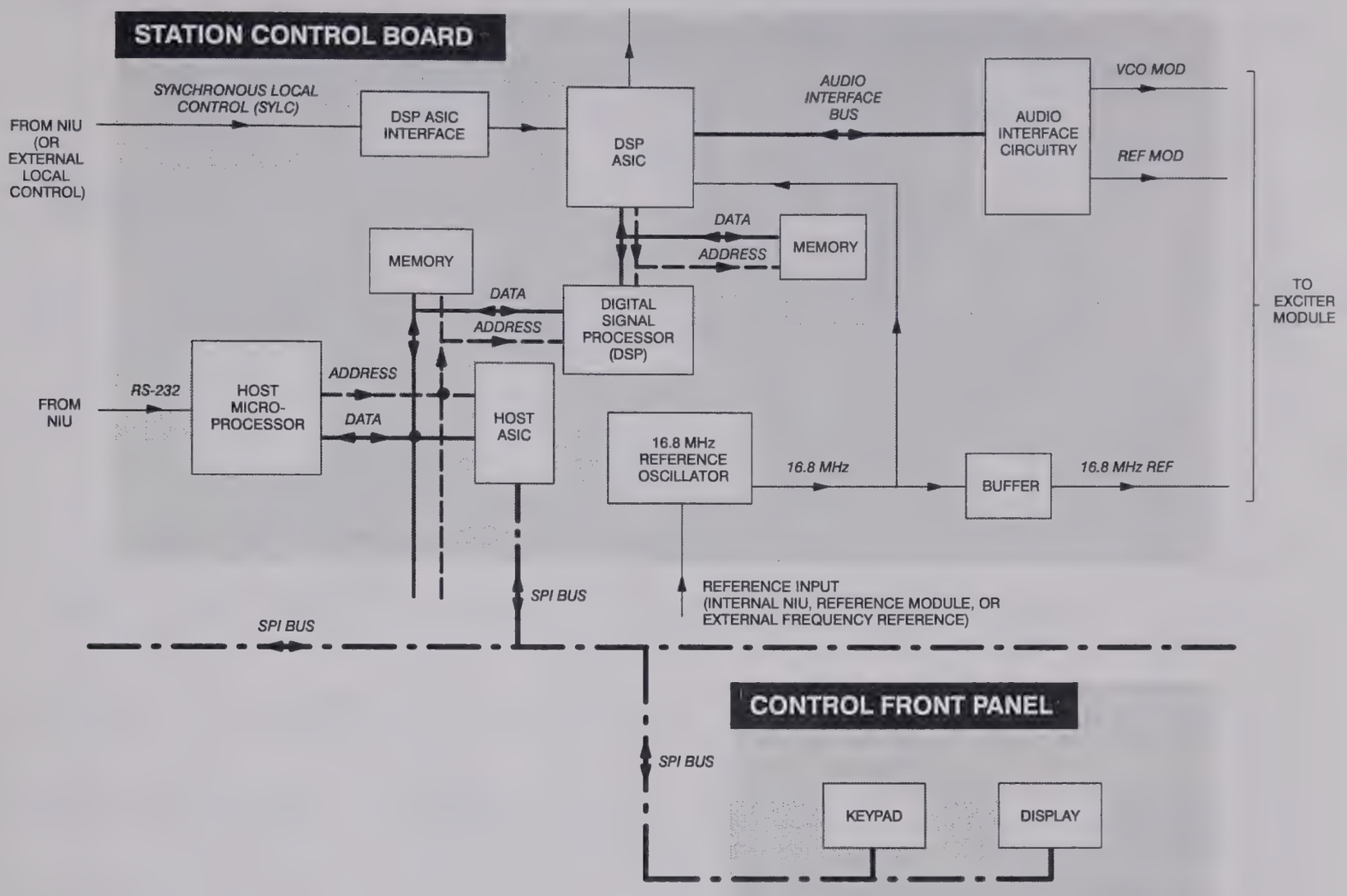
Network Interface Unit (NIU)

In the C-NET system, a data stream is sent out from the C-NET control point (CIU/NCU) to multiple paging stations. The C-NET data stream contains paging data, synchronization information, and other instructions. The Network Interface Unit (NIU) decodes the C-NET data stream and extracts only the paging data and instructions that are addressed to it in particular.

Most *Nucleus* Paging Stations have an Internal NIU located behind the Control front panel. (If no internal NIU is present, an external NIU or other external local control device is required.)

The C-NET data stream input into the NIU can be audio wireline, satellite downlink (analog or digital), or receiver audio. A link modem (QAM) is required for wireline, analog satellite, or link receiver input. A dial modem is required for Public Switched Telephone Network (PSTN) diagnostics. After processing, the NIU sends the data in Synchronous Local Control (SYLC) format to the Station Control Board (SCB).

The Internal NIU also provides a reference frequency for the *Nucleus* station which is sent to the SCB. Additional control, configuration, and diagnostic messaging takes place between the Internal NIU and the SCB via an internal RS-232 connection.



Station Control Module (Station Control Board and Control Front Panel)

The Station Control Board translates the paging data received from the Internal NIU (in SYLC format) into the signals that modulate the Variable Control Oscillator (VCO) on the Exciter Module. These signals are VCO MOD, which controls the impulse response, and REF MOD, which modulates the reference frequency for long-term deviation accuracy.

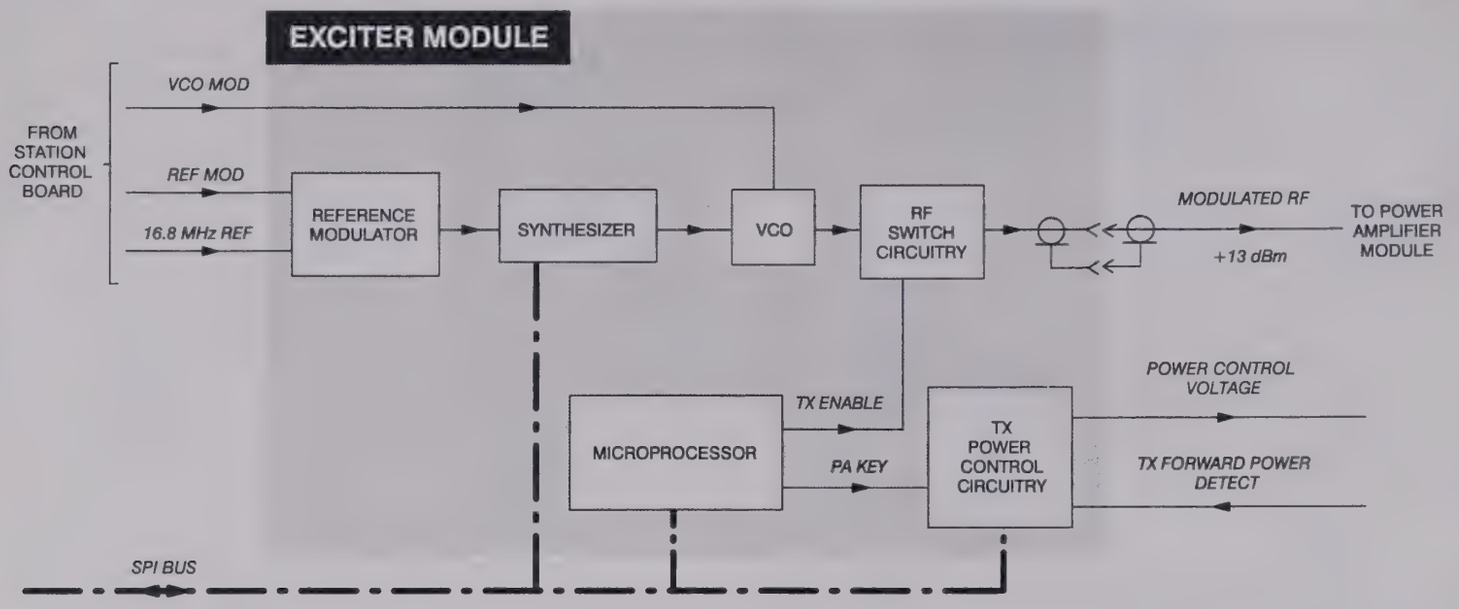
The SYLC paging data from the Internal NIU is processed on the Station Control Board by the Digital Signal Processor (DSP), DSP ASIC, and DSP ASIC Interface. The signal is output in digitized form and sent to the Audio Interface Circuitry, where it is converted to analog, level shifted and amplified, and fed to a reconstruction filter. The output of the filter is then output to the Exciter Module as the VCO MOD signal.

To prevent the transmit signal from "splattering" into adjacent transmit channels, a splatter filter implemented in the DSP eliminates higher frequency modulation components. The particular splatter filter (88, 140, or 250 µs) can be chosen using the Control Front Panel to match other paging stations being simulcast with the *Nucleus* Paging Station.

The reference modulation signal, which is used to modulate the exciter reference frequency, is also sent from the DSP circuitry to the Audio Interface Circuitry, and then output to the Exciter Module as the REF MOD signal.

The Host Microprocessor controls the operation of the station as determined by the station software and parameters. You can program or verify control parameters using the Control Front Panel, which includes a 15-pushbutton keypad and LED display.

The Serial Peripheral Interface (SPI) bus is used as a general-purpose communications bus to allow the Host Microprocessor to communicate with other modules in the station, via the Host ASIC. This allows alarm information to be displayed on the Control Front Panel.



Exciter Module

The Exciter Module generates the modulated rf paging signal at the desired transmit frequency. This signal is then sent to the Power Amplifier Module.

The reference modulator receives a 16.8 MHz reference signal from the Station Control Board. The reference signal is modulated by the reference modulation (REF MOD) signal. The resultant modulated reference signal is sent to the Synthesizer.

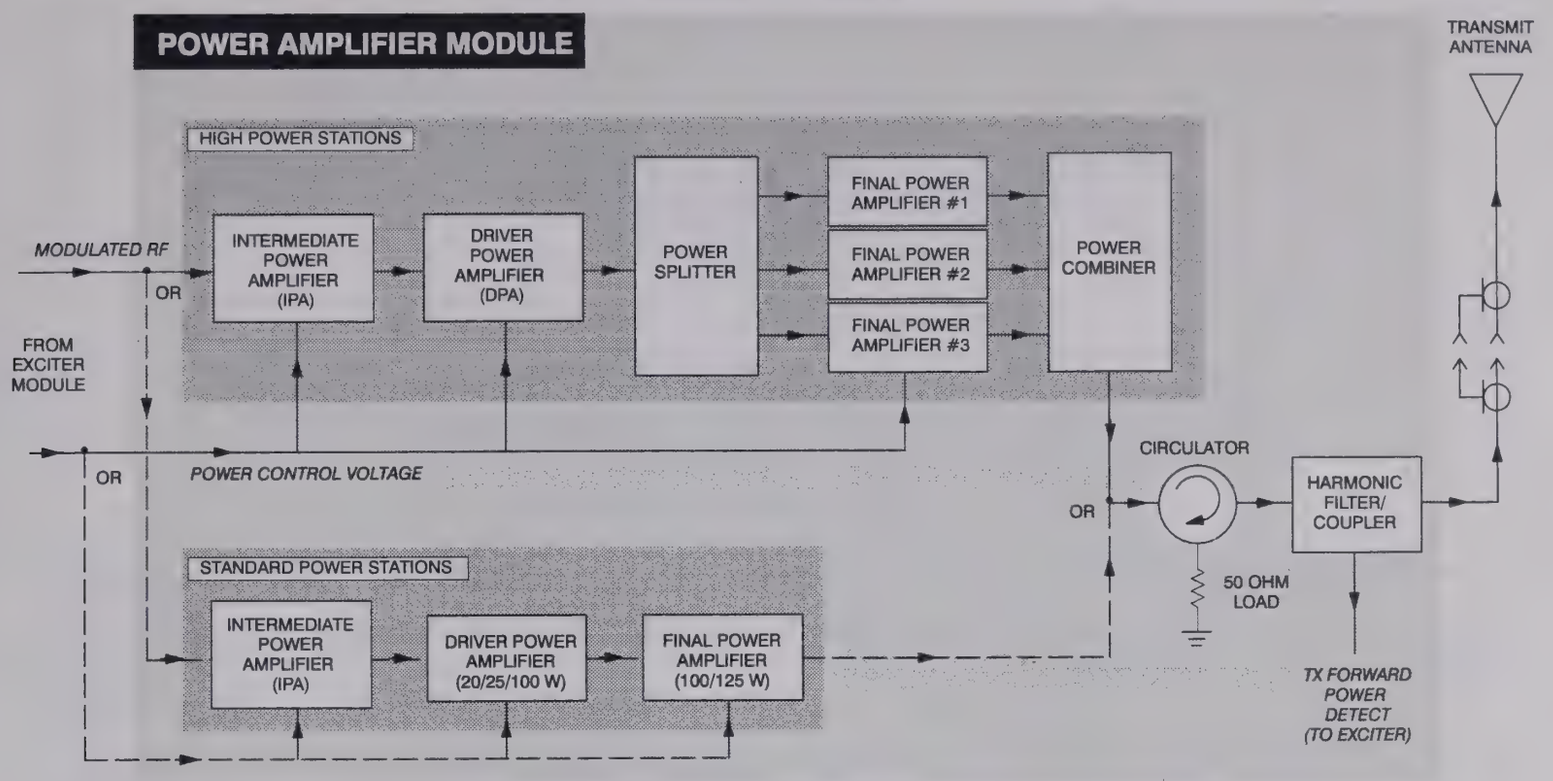
The Synthesizer compares the modulated reference signal with a feedback sample of the VCO output. Depending on whether the feedback signal is higher or lower in frequency than the modulated reference, correction pulses are generated. These pulses are then fed to a charge pump which outputs a dc control voltage.

The dc control voltage from the synthesizer is fed to the VCO. The VCO also receives an audio/data modulation signal (VCO MOD) from the Station Control Board that modulates the VCO to produce a modulated low-level rf carrier signal. This signal is fed through impedance matching, amplification, and filtering and is sent to the RF Switch Circuitry, and then output to the Power Ampllifier Module.

There are two VHF Exciter Modules: 132 to 154 MHz and 150 to 174 MHz.

The 280 MHz Exciter Module covers the range from 276 to 284 MHz.

The 900 MHz Exciter Module covers the range from 928 to 944 MHz.



Power Amplifier Module

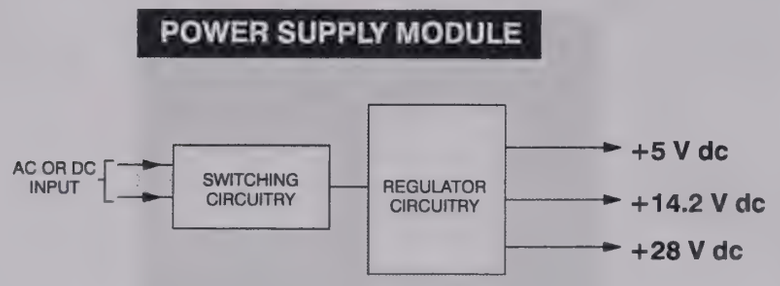
The Power Amplifier Module takes the modulated rf paging signal and amplifies it in preparation for transmission. Finally, the paging signal is sent out over-the-air via an external transmit antenna.

The circulator provides 20 dB isolation between the power amplifier circuitry and the transmit antenna system. The circulator junction allows forward rf energy to pass through to the output, while routing any reflected rf energy to the 50-ohm load. If the heat sink temperature exceeds a preset threshold, the power amplifier will reduce output. If over-temperature persists, it will shut down completely. The harmonic filter reduces circulator harmonics. For improved isolation, there are circulator options available to add one or two circulators to the station.

An internal wattmeter allows front panel metering of rf power and VSWR.

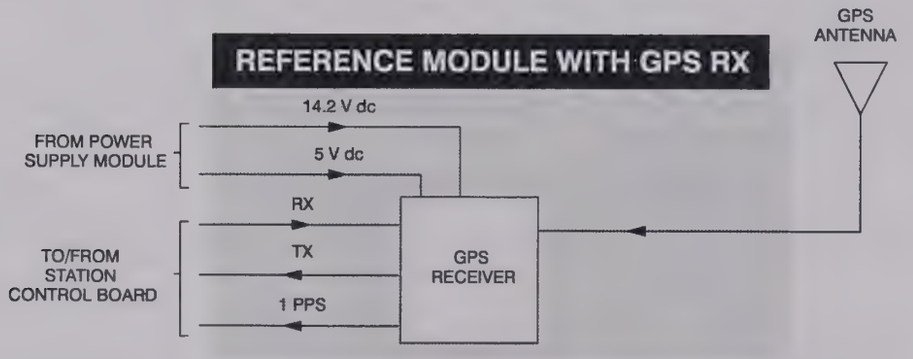
The available Power Amplifier Modules are shown in the following table, along with the corresponding Exciter Modules and the resulting transmit frequency ranges.

PA Module Full Power	PA Module Frequency Range	Exciter Module Frequency Range	Transmit Frequency Range
25 W (VHF)	132 to 174 MHz	132 to 154 MHz	132 to 154 MHz
		150 to 174 MHz	150 to 174 MHz
125 W (VHF)	132 to 154 MHz	132 to 154 MHz	132 to 154 MHz
	150 to 174 MHz	150 to 174 MHz	150 to 174 MHz
350 W (VHF)	132 to 146 MHz	132 to 154 MHz	132 to 146 MHz
			144 to 154 MHz
	144 to 160 MHz	150 to 174 MHz	150 to 160 MHz
	157 to 174 MHz		157 to 174 MHz
125 W (280 MHz)	276 to 284 MHz	276 to 284 MHz	276 to 284 MHz
300 W (280 MHz)	276 to 284 MHz	276 to 284 MHz	276 to 284 MHz
20 W (900 MHz)	928 to 960 MHz	928 to 944 MHz	928 to 944 MHz
100 W and 300 W (900 MHz)	928 to 944 MHz	928 to 944 MHz	928 to 944 MHz



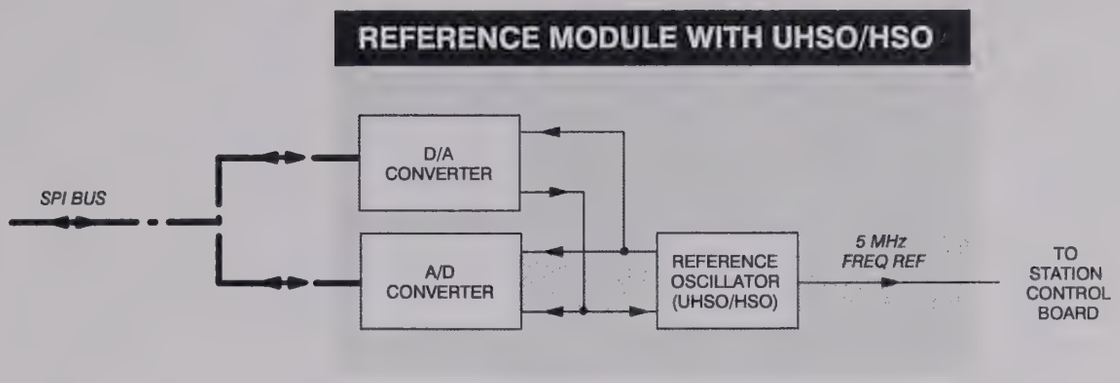
Power Supply Module(s)

The Power Supply Module supplies the various dc voltages required by the modules of the *Nucleus* Paging Station. A high-power station has two Power Supply Modules.



Reference Module with GPS Receiver Only *(for stations with Internal NIU)*

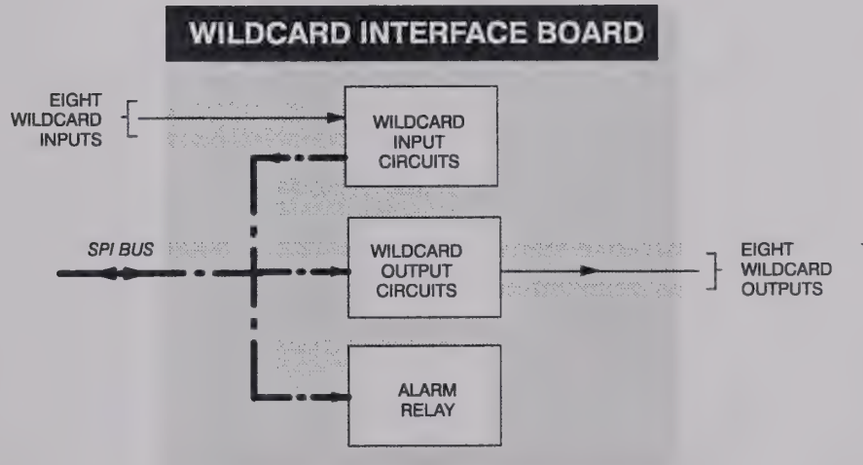
The optional Reference Module with GPS Receiver provides a Global Positioning System (GPS) receiver, which is used if the *Nucleus* Paging Station with Internal NIU is part of a C-NET system that uses GPS Synchronization. The GPS antenna receives rf broadcasts from GPS satellites and outputs the 1.57542 GHz signals to the receiver. The receiver uses its location information and the satellite broadcast data to precisely determine a timing pulse output. The timing pulse transition edge is aligned to coincide with GPS one-second boundaries. The one-pulse-per-second timing pulse is routed from the Reference Module to the other modules which require the timing pulse. The GPS receiver can identify the GPS time (year, month, day, hour, minute, and second) which corresponds to a given timing pulse.



Reference Module with UHSO or HSO *(for stations without Internal NIU)*

The optional Reference Module with UHSO or HSO provides an Ultra High-Stability Oscillator (UHSO) or a High-Stability Oscillator (HSO), which is a 5 MHz reference that stabilizes the 16.8 MHz reference oscillator on the Station Control Board. (The 16.8 MHz reference signal is then sent to the Exciter Module.)

This version of the Reference Module is for stations without an Internal NIU, since the Internal NIU has its own reference oscillator which is used by the station. Since there is no Internal NIU, an External Local Control device (such as an External NIU) must be used with the station.



Wildcard Interface Board *(for stations without Internal NIU)*

The optional Wildcard Interface Board can only be present if there is no Internal NIU in the *Nucleus* Paging Station. It consists of eight TTL-compatible inputs that may be used to monitor external site equipment, and eight open-collector outputs which may be used to indicate station alarms.

Since there is no Internal NIU in the station, an External Local Control device (such as an External NIU) must be used with the station.

3 INSTALLATION OVERVIEW

Proper installation is important to ensure the best possible performance and reliability of the paging station equipment. Vital to a correct installation is pre-installation planning, including consideration of the mounting location of the equipment in relation to input power, antenna(s), and telephone interfaces. Also to be considered are site environmental conditions, the choice of mounting method, and required tools and equipment. The following paragraphs provide details on these and other pre-installation considerations.

– IMPORTANT –

If this is your first time installing this type of equipment, it is highly recommended that you completely read all Installation sections before beginning the actual installation.

General

This section is intended to serve as an overview for installing the *Nucleus* Paging Station and ancillary equipment. Procedures for each of the major tasks are provided in the following sections.

- Plan the installation, paying particular attention to environmental conditions at the site, ventilation requirements, and grounding and lightning protection.
- Unpack and inspect the equipment.
- Mechanically install the equipment at the site.
- Complete necessary electrical and cabling connections, including the following:
  - Site grounding
  - AC or DC input power cabling
  - Coaxial cables to transmit and receive antennas
  - Phone line connections
  - Site lightning protection
- Perform a post-installation functional checkout test of the equipment to verify proper installation.

FCC Compliance

NOTE: *The efficiency of the equipment depends upon proper installation and service. Motorola recommends that this equipment be installed and serviced* ***only*** *by certified technicians.*

FCC requirements state the following:

- The grantee of a license has the responsibility of ensuring that all equipment operated under that license conforms to the specifications of the license.
- The rf power output of a radio transmitter shall be no more than required for satisfactory technical operations considering the area to be covered and the local conditions.
- The frequency, deviation, and power of a radio transmitter must be maintained within specific limits. It is recommended, therefore, that these three parameters be checked before the station is placed in service.

Site Grounding and Lightning Protection

CAUTION

Proper site grounding and lightning protection are vitally important considerations. Failure to provide proper lightning protection may result in catastrophic damage to the paging station equipment.

CAUTION

Do not work on stations during thunderstorms or when lightning is in the area!

CAUTION

Failure to observe proper anti-static grounding procedures may cause catastrophic damage to the equipment. ***Always*** wear a grounded wrist strap when handling modules or cards.

The conditions that make a site desirable for two-way radio communications are the same that make a site an excellent target for lightning strikes. Proper lightning protection methods can prevent equipment damage in all but the most severe strikes. Even then, equipment damage may be kept to a minimum. Lightning protection is intended to prevent the electrical energy from a strike from entering the equipment room, and then preventing damage to the equipment as a result of induced voltages on power, signal, and control lines to the equipment.

Site Grounding

Electrical Ground — Ground wires carrying electrical current from circuitry or equipment at the site is included in the category of electrical ground. Examples include the ac or dc electrical power used to source equipment located at the site, telephone lines, and wires or cables connected to alarms or sensors located at the site.

RF Ground — This type of ground is related to the transmission of radio-frequency energy to earth ground. An example of rf grounding is the use of shielding to prevent (or at least minimize) the leakage of unwanted rf transmissions from communications equipment and cables.

Lightning Ground — Providing adequate lightning protection is critical to a safe and reliable communications site. Telephone lines, rf transmission cables, and ac and dc power lines must all be protected to prevent lightning energy from entering the site building.

Station Ground Lug

The *Nucleus* Paging Station cage is equipped with a single ground lug located on the station Backplane. Use this lug to connect the cage to the site ground point. It is assumed that all telephone lines, antenna cables, and ac or dc power cabling have been properly grounded and lightning protected.

Although a comprehensive coverage of site grounding techniques and lightning protection is not within the scope of this instruction manual, there are several excellent industry sources for rules and guidelines on grounding and lightning protection at communication sites. Motorola recommends the following reference source:

Quality Standards – FNE Installation Manual R56
(Motorola part number 68P81089E50)

This manual can be ordered from the Motorola Parts Division at (800) 422-4210.

Electrostatic Grounding

All *Nucleus* Paging Stations have provisions for electrostatic grounding. The formed tube at each side of the front of the card cage chassis is marked with the grounding symbol. When handling any module or circuit board, be sure to wear an anti-static wrist strap and plug the banana plug connector into the ground receptacle (formed tube) on the card cage.

Environmental Conditions at Intended Installation Site

IMPORTANT

If the station is to be installed in an environment which is unusually dusty or dirty (and thus does not meet the air quality requirements), the air used to cool the station modules must be treated using appropriate filtering devices. Dust or dirt accumulating on the internal circuit boards and modules is not easily removed, and can cause such malfunctions as overheating and intermittent electrical connections.

The *Nucleus* Paging Station may be installed in any location suitable for electronic communications equipment, provided that the environmental conditions do not exceed the equipment specifications for temperature, humidity, and air quality. These are:

Operating Temperature Range: −30 to +60°C (−22 to +140°F)

Humidity: not to exceed 95% relative humidity @ 50°C

Air Quality: For equipment operating in an environmentally controlled environment with the station cage(s) rack mounted, the airborne particulates level must not exceed 25 $\mu g/m^3$.

For equipment operating in an area which is not environmentally controlled [station cage(s) cabinet mounted], the airborne particulates level must not exceed 90 $\mu g/m^3$.

Equipment Ventilation

CAUTION

Failure to ensure proper ventilation and cooling will void the product warranty if the station fails due to overheating.

The power amplifier and power supply modules are equipped with thermistor-controlled cooling fans that are used to provide forced convection cooling. The air flow is front to back, allowing several station cages to be stacked within a rack or cabinet. When planning the installation, observe the following ventilation guidelines:

- Customer-supplied cabinets must be equipped with adequate ventilation slots or openings in the front (for air entry) and back (for air to exit). If several station cages are installed in a single cabinet, be sure adequate ventilation in the front and rear of the cabinet exists for proper cooling.
- All cabinets must have at least 6 inches of open space between the air vents and any walls or other cabinets. When positioning the cabinets be careful that the air intake of one cabinet is not in close proximity to the air exhaust of an adjacent cabinet. This allows adequate air flow for cooling purposes.
- When multiple cabinets, each equipped with several station cages, are installed in an enclosed area, make sure the ambient temperature of the room does not exceed the recommended maximum operating temperature (−30°C to +60°C/−22°F to +140°F). It is recommended to have air conditioning or other climate control equipment installed to satisfy the environmental requirements.

Input Power Requirements

The *Nucleus* Paging Station is equipped with either an ac power supply (90 to 280 V rms, 50 or 60 Hz) or a dc-dc power supply (21 to 34.5 V dc or 41 to 72 V dc). All ac power supplies feature automatic range and line frequency selection.

It is recommended that a standard 3-wire grounded electrical outlet be used as the ac source. For a 125 W station and a nominal 110 V ac input, the ac source must supply 5 A and should be protected by a circuit breaker rated at 15 A. For a nominal 220 V ac input, the ac source must supply approximately 2.5 A.

For a 900 MHz, 300 W station, two power supplies are used, which draw a total of 18 A at 110 V ac, 60 Hz. Use a circuit breaker rated at 20 A.

For a 24 V dc or 48/60 V dc source, appropriate cabling from the dc power source to the Backplane (located at rear of station) is supplied.

Equipment Mounting Methods

The *Nucleus* Paging Station equipment may be mounted in a variety of racks and cabinets (available as options), as follows:

- Shipped in 25″ cabinet (Option X92) — formed cabinet with front and rear vented doors.
- Shipped in 46″ cabinet (Option X308) — formed cabinet with front and rear vented doors.
- Shipped in 70″ cabinet (Option X36) — formed cabinet with front and rear vented doors.
- Shipped in 2-meter cabinet (Option X307) — formed cabinet with front and rear vented doors.
- Station shipped without rack or cabinet (Option X362) — customer may install station in rack or cabinet of choice; station is designed to fit standard EIA 19″ rack configuration. For rack mounting, order Option X153 mounting brackets.
- 7′ (Model TRN7342), 7½′ (Model TRN7343), or 8′ (Model TRN7344) racks — open frame EIA 19″ racks accept multiple *Nucleus* paging stations and ancillary equipment.

Recommended Tools and Equipment

WARNING

Do not use a metal stepladder. Accidental contact with electrical wires could lead to electrocution or severe injury. Use only *fiberglass* or *wooden* step ladders.

In addition to the typical complement of hand tools, the following tools and equipment are recommended for proper installation of the station equipment.

- Standard electrician's tool box (should contain a variety of hand tools appropriate for working with electrical circuits and associated equipment).
- *TORX*® screwdriver, with TX15 and TX30 bits
- Small adjustable wrench or gas pliers
- Wire cutters (for cutting tie-wraps)
- Fiberglass or wooden stepladder, six to eight feet (used to access the top of the 70″ cabinet and the 7′, 7½′, and 8′ racks, if applicable).
- Block-and-tackle or suitable hoist is recommended to lift cabinets equipped with multiple stations. Each fully equipped station weighs approximately 60 lbs. (standard power) or 105 lbs. (high power).
- Power drill and appropriate boring bits for drilling concrete (for drilling anchor holes in concrete flooring).
- Tarpaulin or large plastic drop cloth to cover surrounding equipment while drilling concrete anchor holes (for installations where cabinet or rack is being anchored to concrete flooring).
- Vacuum cleaner for removing concrete dust (for installations where cabinet or rack is being anchored to concrete flooring).
- ESD grounding strap.

4 MECHANICAL INSTALLATION

This section describes the procedures necessary to unpack and mechanically install the *Nucleus* Paging Station equipment. A variety of mounting methods are possible, depending on such factors as which type of cabinet or rack (if any) has been selected to house the station cage(s), whether stacking of cabinets is desired, etc. Procedures are provided for each of the cabinet/rack types.

Equipment Unpacking and Inspection

IMPORTANT

Thoroughly inspect the equipment as soon as possible after delivery. If any part of the equipment has been damaged in transit, immediately report the extent of the damage to the transportation company.

Introduction

Nucleus Paging Station equipment packing methods vary depending upon the type of optional rack or cabinet selected by the customer. *Nucleus* station cages may also be packed and shipped without a cabinet. Unpacking procedures for these various methods are provided in the following paragraphs.

The *Nucleus* station may be shipped either by air freight or electronic van (as specified by customer). The packing methods are as follows:

- If no cabinet or rack is selected, the station is shipped in a cardboard container with interior packing supports.
- All other available cabinets are shipped with the *Nucleus* station(s) installed in the cabinet, with the cabinet bolted to a wooden skid and covered with a cardboard box with corrugated interior corner braces.
- Stations ordered for use in open frame racks (7′, 7½′, or 8′ available) are shipped in a cardboard container with corrugated interior corner braces. The rack is shipped separately wrapped in insulating foam.

Unpacking Nucleus *Stations without Cabinets*

Nucleus stations without cabinets (ordered with Option X362, omit cabinet) are packed in a cardboard box with styrofoam interior spacers and cardboard stiffeners. Unpack as described in Figure 4−1.

Unpacking 25″, 46″, and 70″ Indoor Cabinets

These cabinet styles are shipped mounted to a wooden skid, secured with corrugated corner braces held by a plastic strap, and covered with a cardboard cover. Unpack the equipment as described in Figure 4−2.

Equipment Unpacking and Inspection (continued)

1 Cut and remove band around cardboard base. Unfold sides of base in order to release flaps at bottom of cardboard cover.

2 Lift and remove cardboard cover.

3 Remove foam spacers. Line cord and plastic bag containing mounting hardware are located inside container.

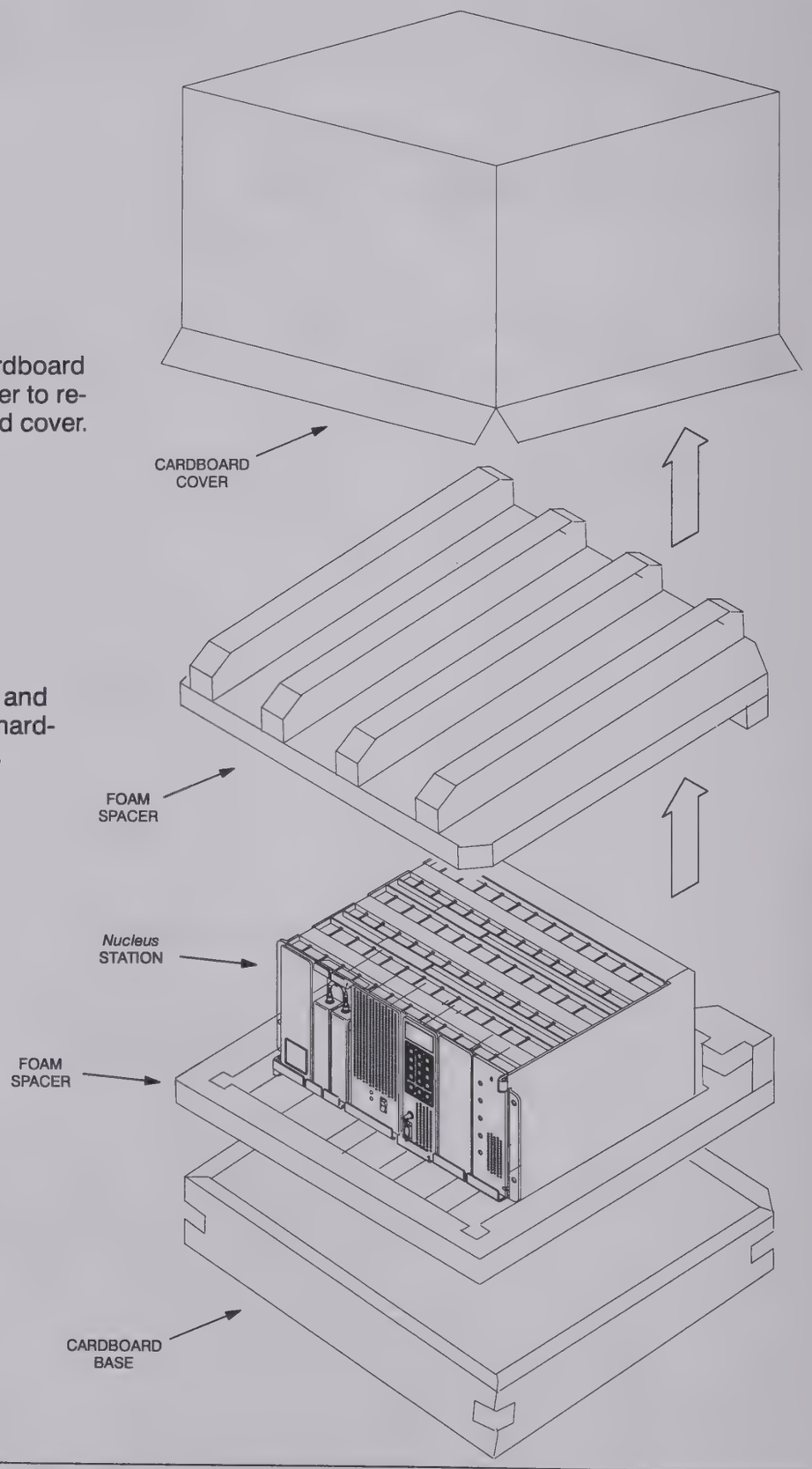
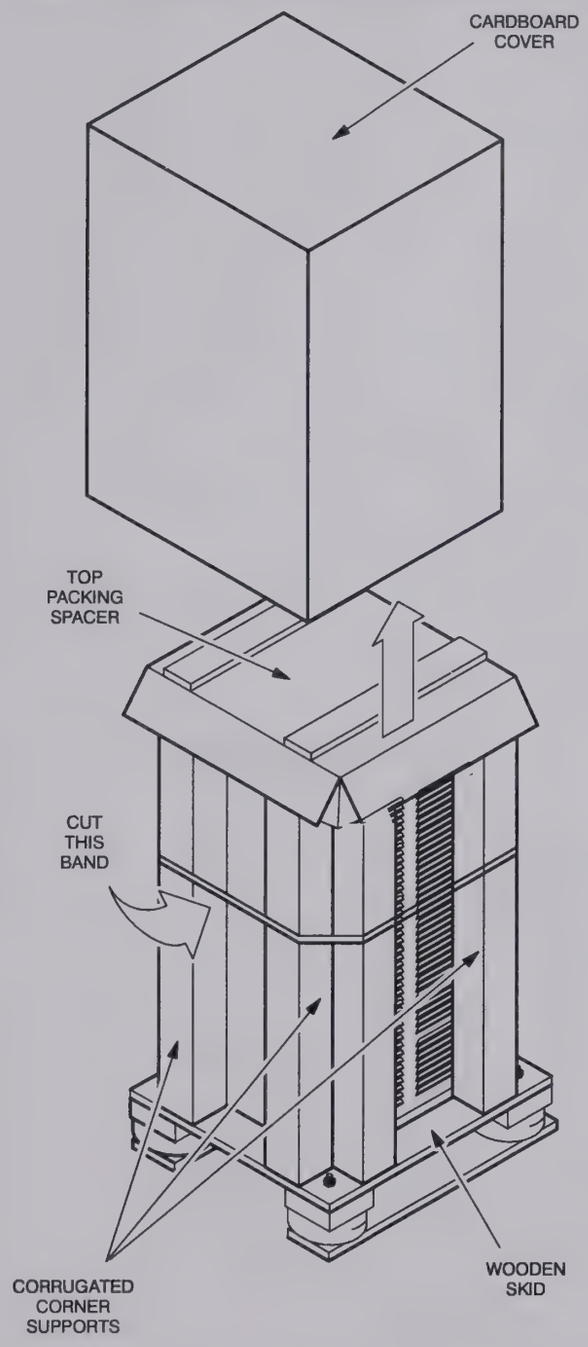


Figure 4–1. *Unpacking Procedures for* Nucleus *Paging Stations without Cabinets*

Equipment Unpacking and Inspection (continued)

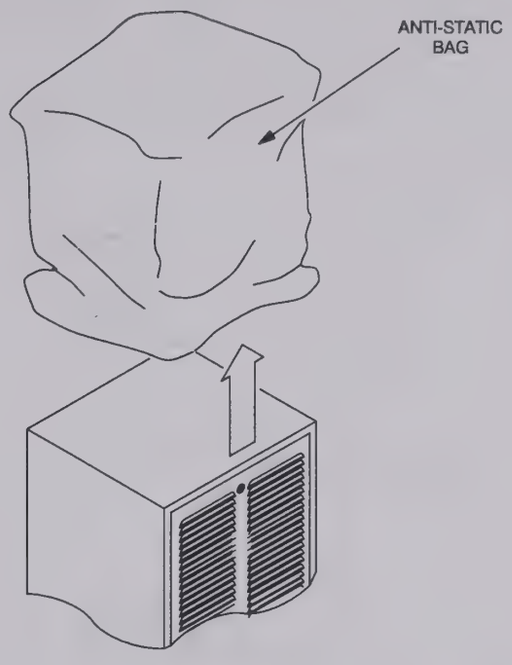
1 Remove staples at base and remove cardboard cover from station.



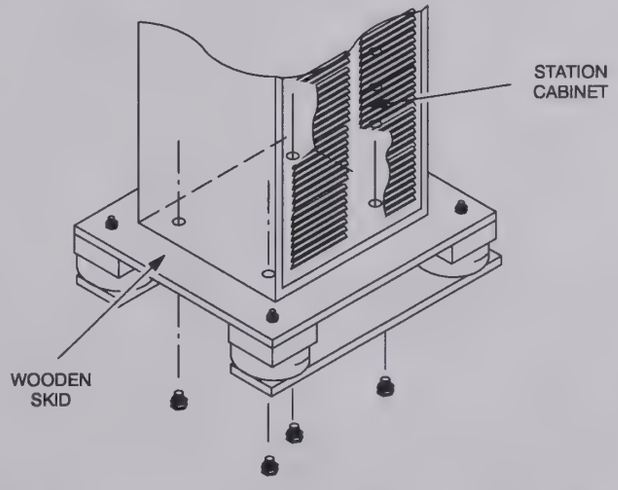
2 Cut band as shown.

3 Remove top packing spacer and corrugated corner supports.

4 Remove anti-static bag. ***Do not*** discard bag. It will be re-installed to protect equipment during installation.



5 Depending on cabinet type, either open or remove front and rear doors to gain access to the four (4) bolts securing the station to the wooden skid. Remove the bolts and nuts as shown.



6 Use hoist to lift the station from the skid. Remove skid and return station to floor.

7 Replace anti-static bag over station to provide protection during installation.

Figure 4–2. *Unpacking Procedures for 25", 46" (shown), and 70" Indoor* Nucleus *Cabinets*

Physical Dimensions and Clearances

Nucleus *Cage without Cabinet*

Figure 4–3 shows the dimensions and recommended clearances for a standard power station and a high power station. Standard and high power station dimensions are identical except for overall height.

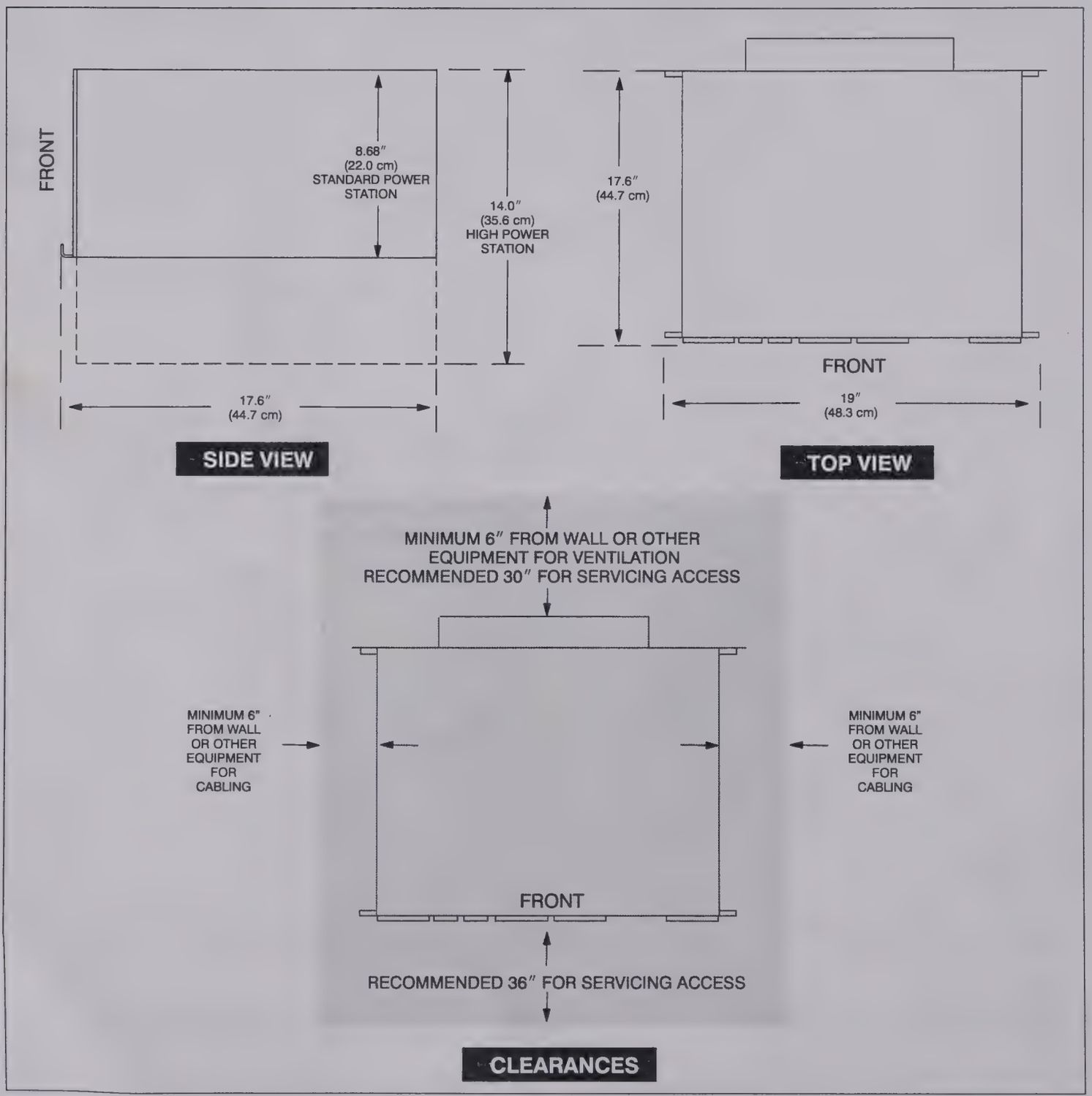


Figure 4–3. Nucleus *Paging Station Dimensions and Clearances*

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Physical Dimensions and Clearances (continued)

Nucleus Cages Installed in 7′, 7½′, and 8′ Racks

Figure 4–4 shows the physical dimensions for all three rack sizes available for mounting *Nucleus* Paging Stations and ancillary equipment.. Shown is the 8′ rack (Model No. TRN7344) with ten (maximum) *Nucleus* cages installed (standard power or high power); 7′ (Model No. TRN7342) and 7½′ (Model No. TRN7343) racks each hold nine maximum. Recommended clearance front and rear is 36″ minimum for service access. Refer to *Equipment Ventilation* in Section 3 for recommended ventilation clearances. Rack mounting requires Option X153 mounting brackets.

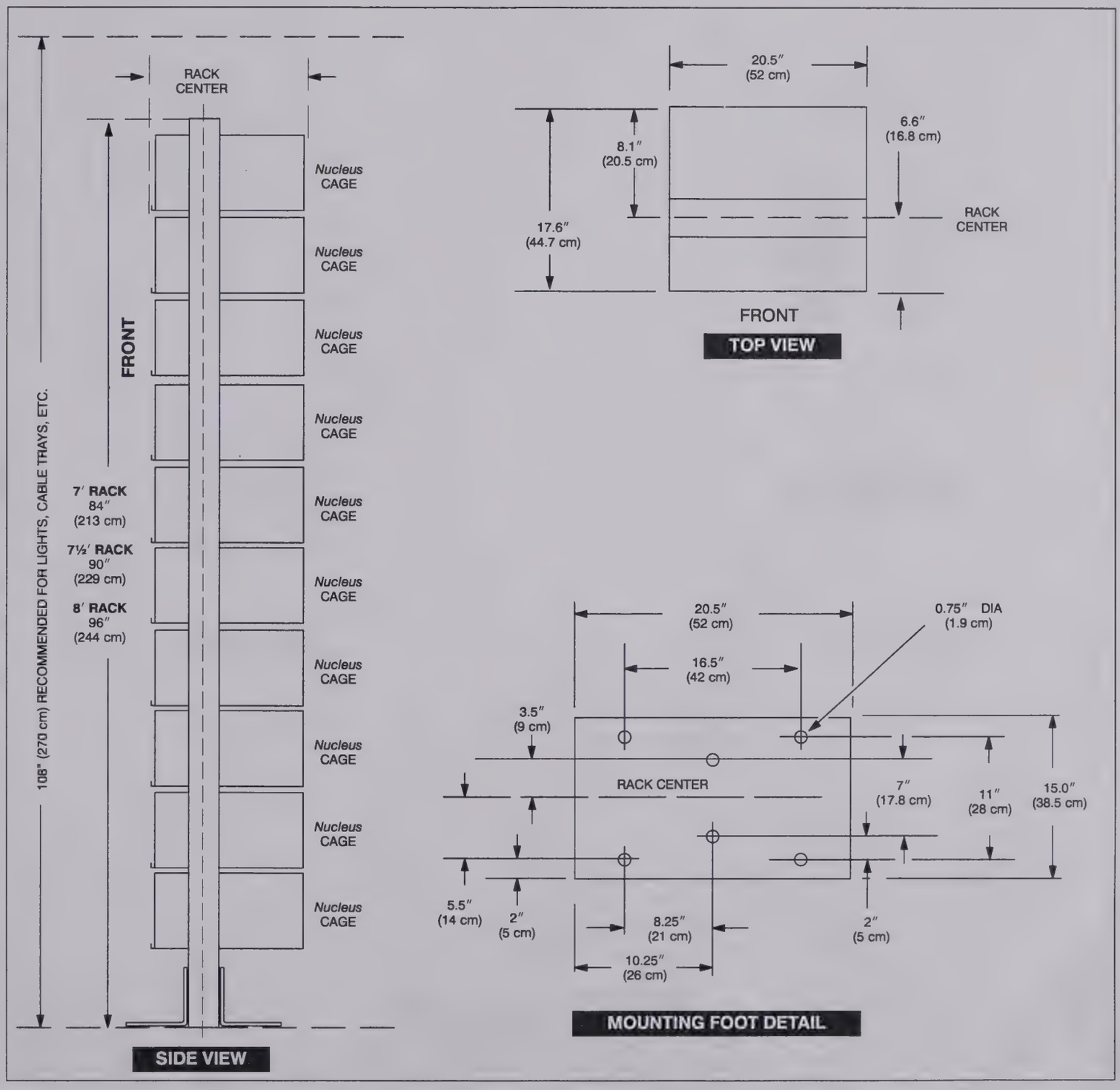


Figure 4–4. *Dimensions and Clearances for 7′, 7½′, and 8′ Racks*

Physical Dimensions and Clearances (continued)

25″ Indoor Cabinet

Figure 4–5 shows the physical dimensions for a 25″ cabinet (Option X92). Minimum recommended clearances are 36″ (front) and 30″ (rear) for installation access. Refer to *Equipment Ventilation* in Section 3 for recommended ventilation clearances.

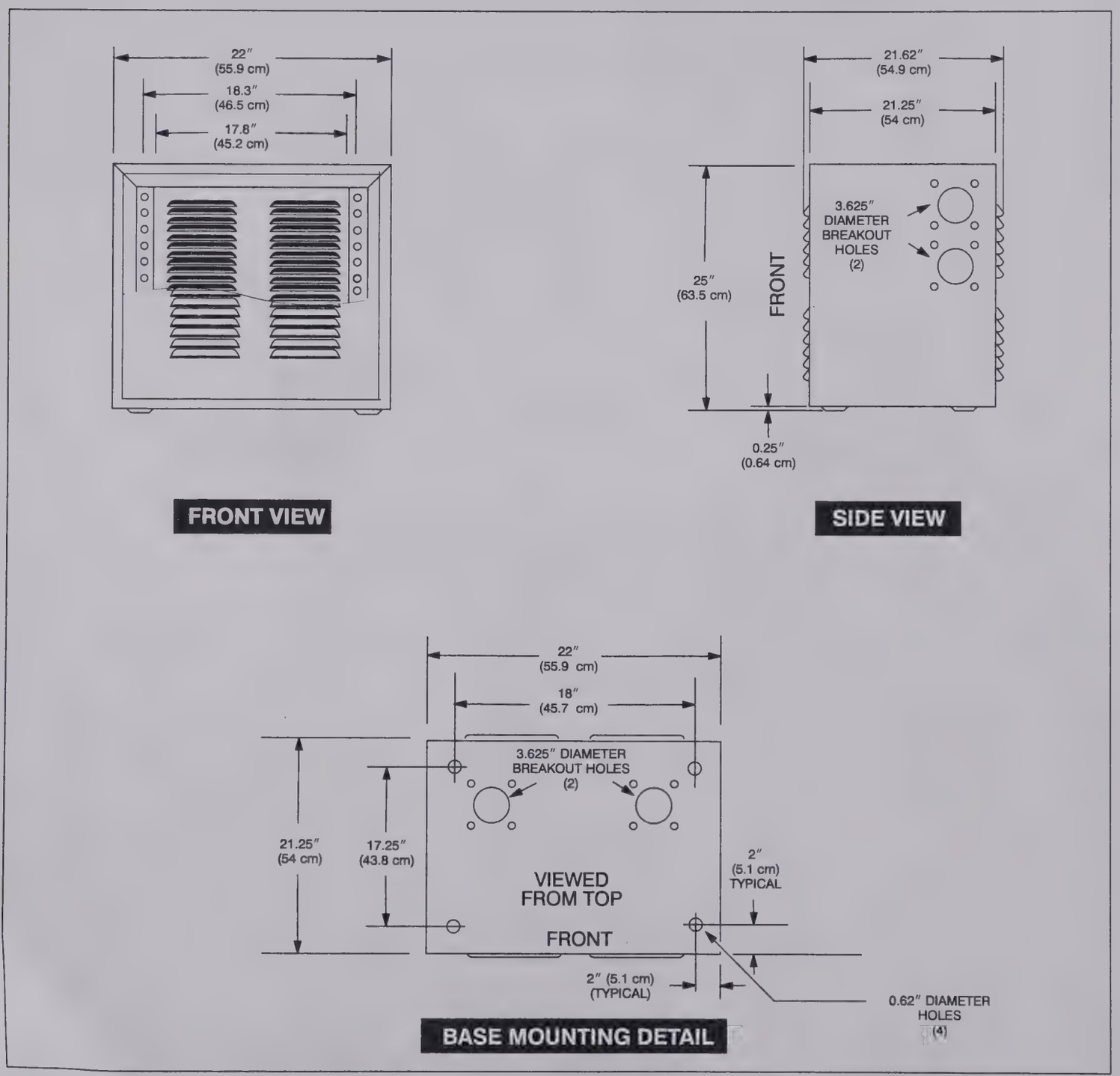


Figure 4–5. *25″ Cabinet Dimensions*

Physical Dimensions and Clearances (continued)

46″ Indoor Cabinet

Figure 4–6 shows the physical dimensions for a 46″ cabinet (Option X308). Minimum recommended clearances are 36″ (front) and 30″ (rear) for installation access. Refer to *Equipment Ventilation* in Section 3 for recommended ventilation clearances.

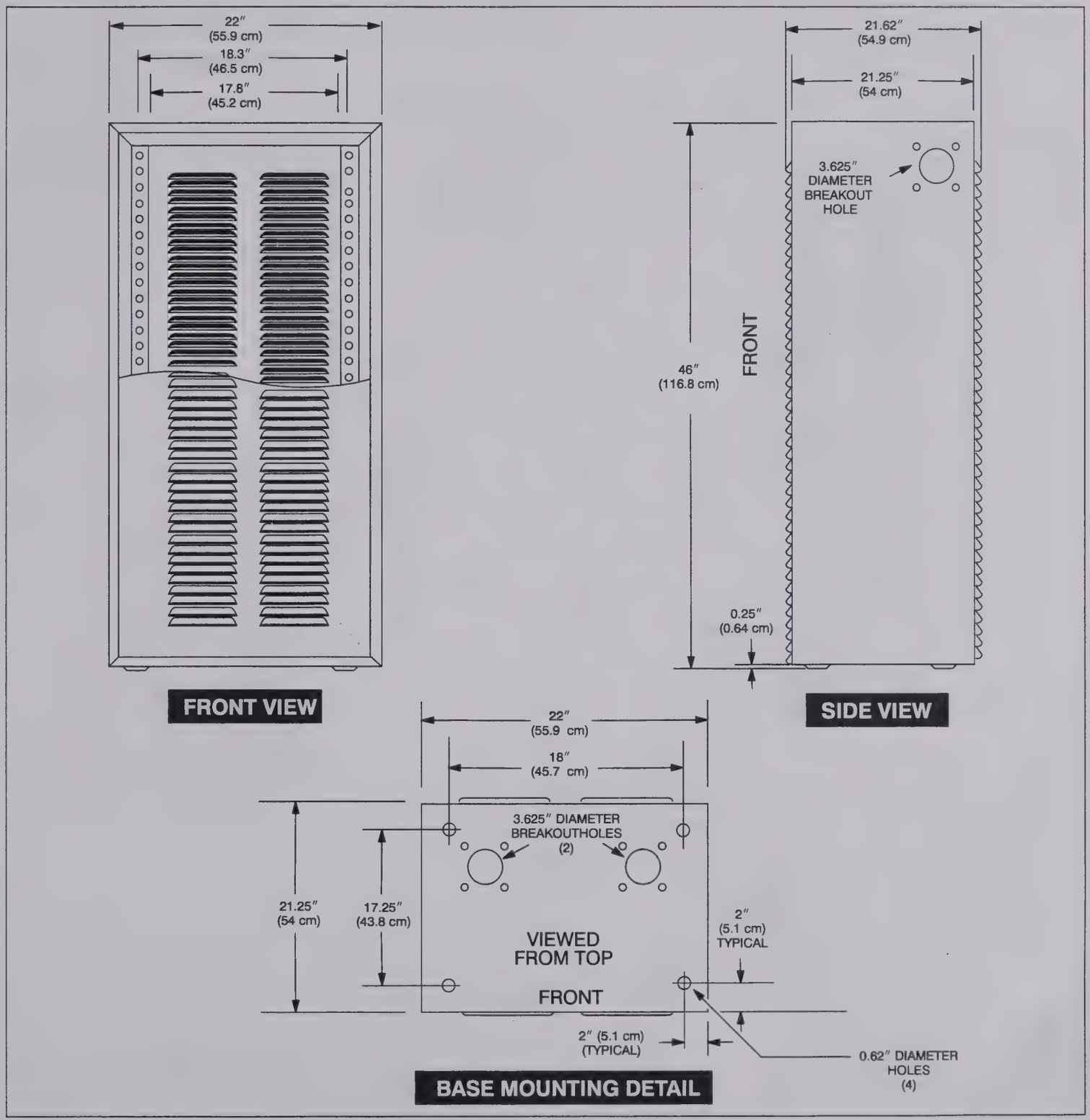


Figure 4–6. *46″ Cabinet Dimensions*

Physical Dimensions and Clearances (continued)

70″ Indoor Cabinet

Figure 4–7 shows the dimensions for a 70″ indoor cabinet (Option X36). Minimum recommended clearances are 36″ (front) and 30″ (rear) for installation access. Refer to *Equipment Ventilation* in Section 3 for recommended ventilation clearances.

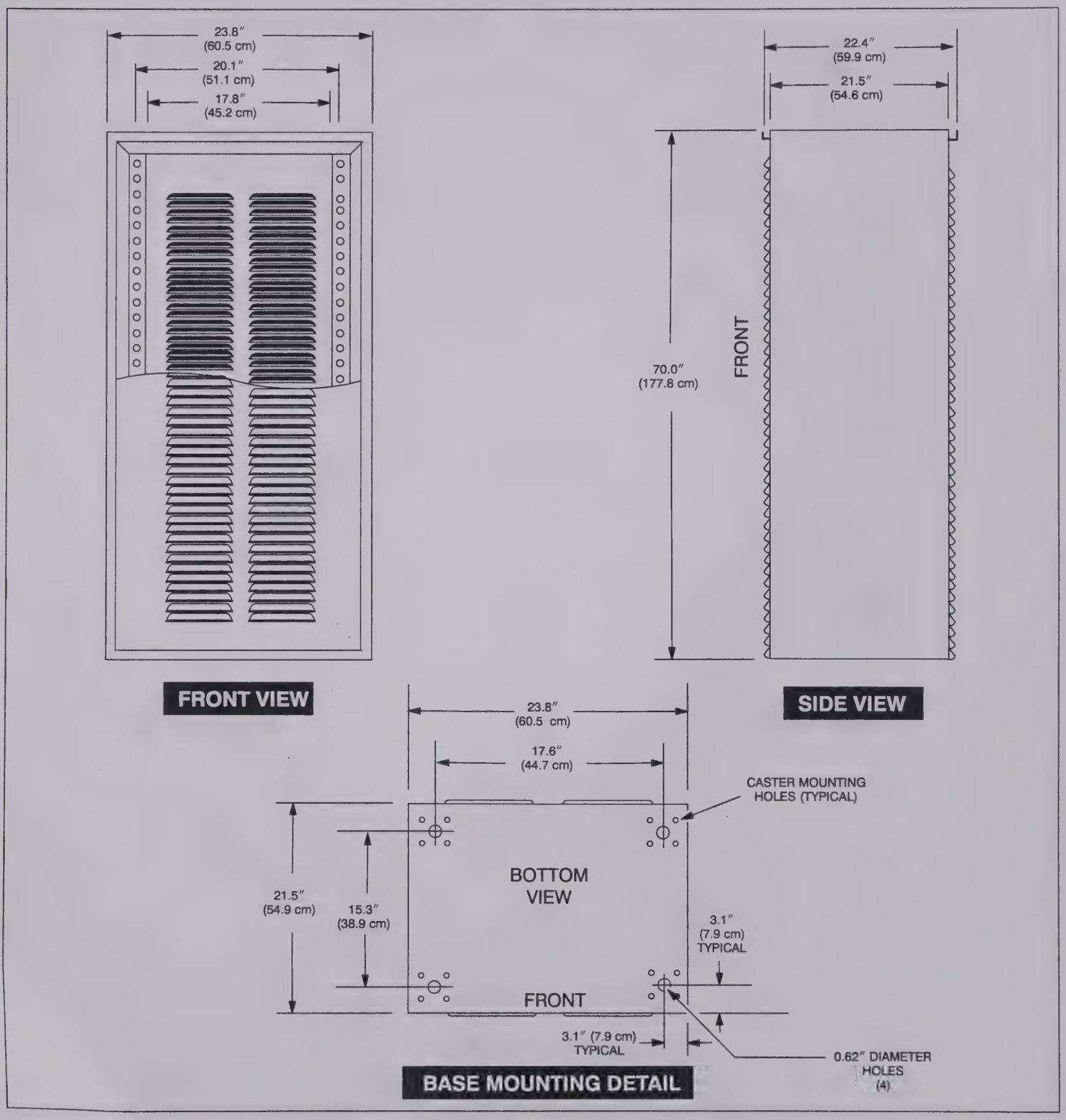


Figure 4–7. *70″ Indoor Cabinet Dimensions*

Cabinet Installation

Installing 25″, 46″, 70″, and 2-meter Indoor Cabinets

Each cabinet bottom has four (4) mounting holes to allow attachment to the site floor. If installing on a concrete floor, use the cabinet to make a template (using the side of the shipping carton), mark the hole locations, and follow the procedures given for anchoring equipment racks (refer to Figure 4–8). If installing on a wooden floor, use lag bolts and washers (customer-supplied) to secure the cabinet to the floor.

Racking Installation

CAUTION

A fully equipped 8′ rack (ten *Nucleus* standard power paging station cages) weighs approximately 650 lbs (245 kg). Handle with extreme care to avoid tipping.

CAUTION

Cement dust from concrete flooring is harmful to electronic equipment and wiring. Make sure that the rack and any co-located equipment are protected prior to drilling holes in the concrete floor. Use a tarpaulin, cloth, or plastic sheeting to cover exposed equipment. (The rack should be already covered with an anti-static bag; do not remove the bag at this time.) Use a vacuum while drilling the holes to minimize the spread of concrete dust. Carefully clean up any accumulated dust and debris from the anchor installation before uncovering the equipment.

Installing 7′, 7½′, and 8′ Racks

In a typical installation, the rack is bolted to a concrete floor to provide stability. The following procedure describes the steps necessary to bolt the rack to a concrete floor. Be sure to check with local authorities to verify that the following procedure conforms to local building codes and regulations ***before permanently installing the rack***.

Step 1. Carefully align the rack at the desired anchoring location.

Step 2. Use the rack mounting foot as a template and mark the location of the six, ¾″ (1.9 cm) diameter mounting holes. All six anchoring positions must be used.

Step 3. Move the rack aside, drill holes in the concrete floor, and install the mounting anchors (RAM RD-56 anchors recommended) per instructions provided with the anchors. Make sure that the anchors do not come in contact with the reinforcing wire mesh buried in the concrete; the rack *must be* electrically isolated from any other equipment or materials at the site.

Step 4. Align the rack with the installed anchors and lightly secure the rack to the floor using the proper mounting hardware. ***Do not tighten the mounting hardware at this time.***

Step 5. Check the vertical plumb of the rack. Also check that the top is level. Use shims (flat washers or flat aluminum plates) as necessary under the rack mounting foot to achieve vertical plumb and horizontal level.

Step 6. Tightly secure the rack to the floor anchors making sure that it remains vertically plumb and horizontally level.

Step 7. After all debris is removed and cement dust is cleared away, remove whatever protective covering has been placed on the equipment, including the anti-static bag.

Mounting Procedures

Introduction

Perform the following procedures to mechanically install the *Nucleus* station equipment cages. Note that some cabinets may be stacked, one atop the other, to minimize space requirements.

The standard power *Nucleus* stations and the high power *Nucleus* stations have different mounting procedures. Refer to the mounting procedures for your type of station.

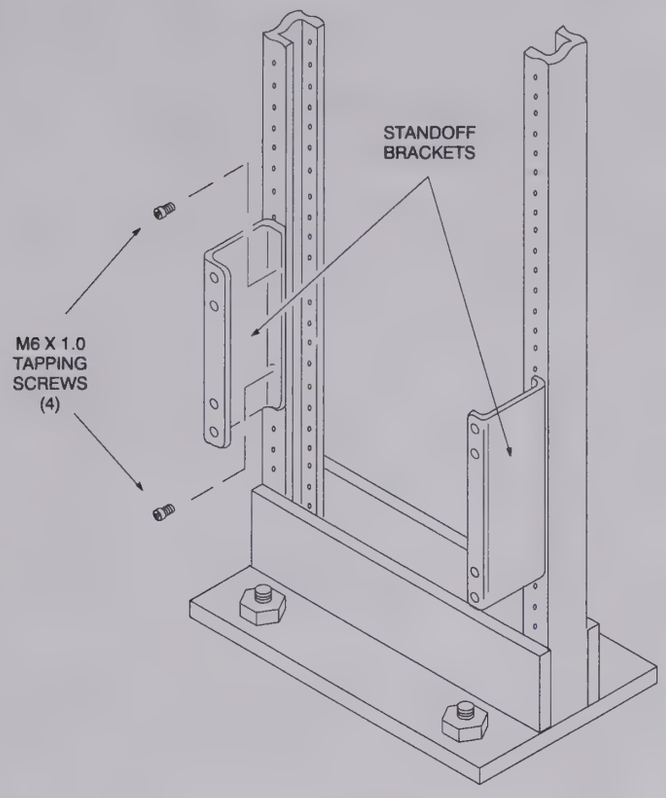
Mounting Nucleus *Station Cage(s) in an EIA Rack*

Before mounting *Nucleus* equipment, ensure that the rack is securely fastened to the floor at its base.

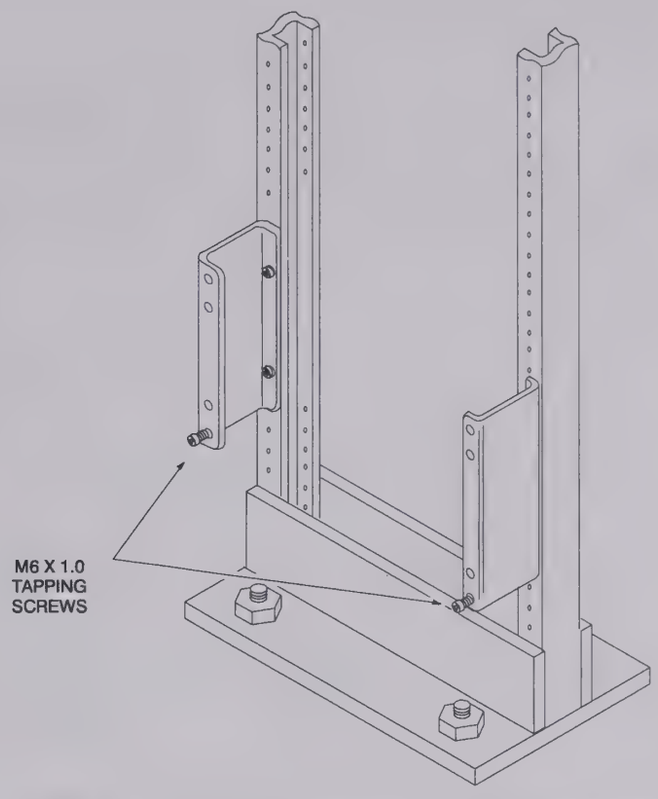
Nucleus Paging Stations intended for field-mounting in an EIA rack require standoff brackets to center the cage within the rack mounting rails. Order Option X153, which includes mounting brackets and slotted screws. Mount the cage(s) as described in Figure 4–8.

When installing multiple stations, it is recommended that you mount the first station in the lowest possible position in the rack, then continue building towards the top with the additional stations. Mounting screws (M6 x 1.0 tapping) are provided with each station to secure the cage flanges to the standoff brackets.

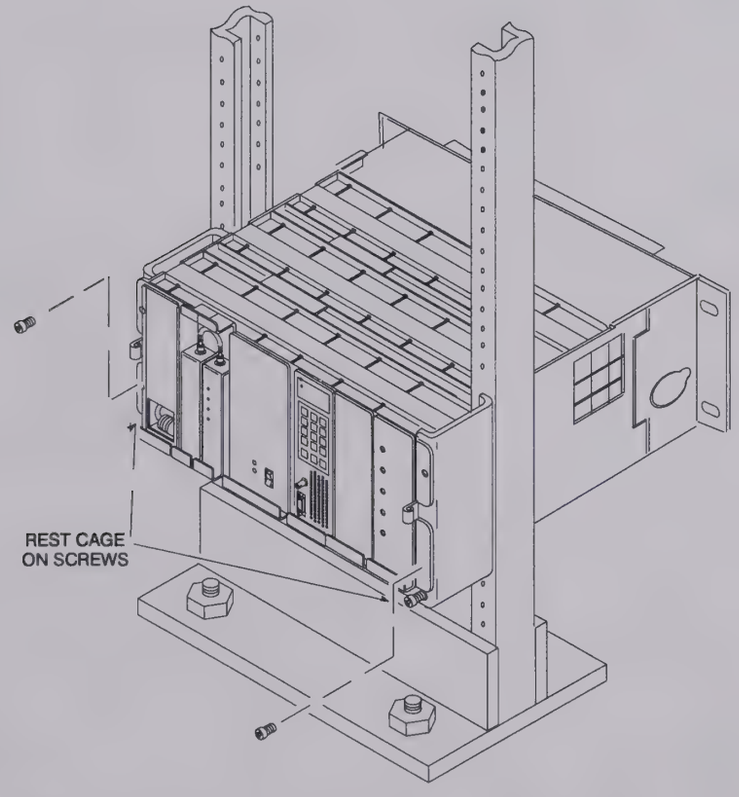
Installing multiple cages one above the other is permitted as long as proper ventilation is maintained. Refer to *Equipment Ventilation* in Section 3 for further details.



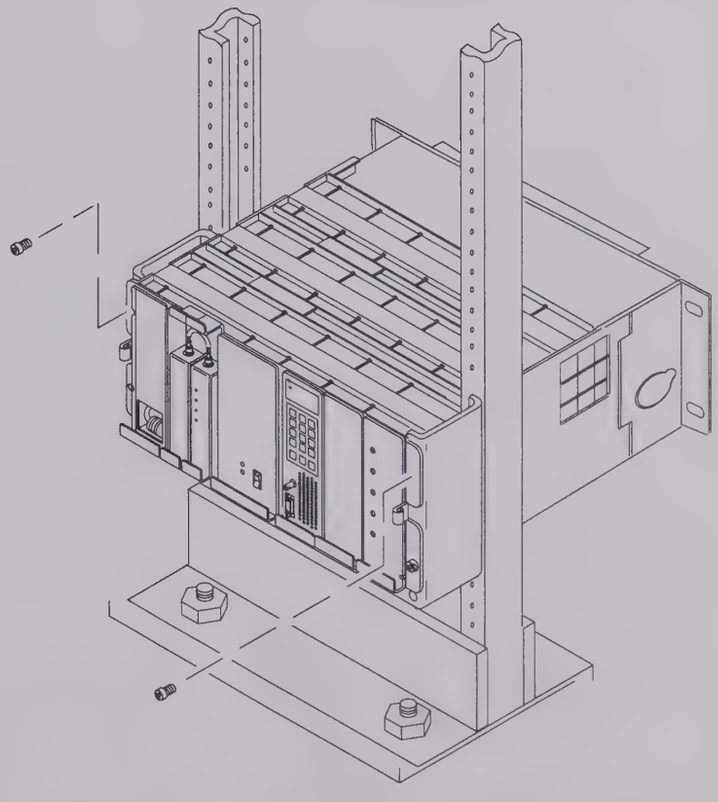
1 Position standoff brackets at desired position on rack (as shown). Secure to rack using M6 x 1.0 tapping screws.



2 Partially install M6 x 1.0 tapping screws in bottom holes in brackets, as shown.



3 Rest cage on lower two screws and install two M6 x 1.0 tapping screws in holes as shown. Tighten securely.



4 Remove two screws used to support cage and install in the upper two holes of the brackets. Tighten securely.

Figure 4–8. *Installation Procedure for Rack Standoff Brackets (Standard Power Chassis Shown)*

Mounting Procedures (continued)

Mounting the Standard Power Station in an EIA Standard 19″ Panel Width Motorola Cabinet

The following tools are required to perform this installation procedure:

- *TORX* screwdriver, with TX15 and TX30 bits
- Small adjustable wrench or gas pliers
- Wire cutters (for cutting tie-wraps)

The following hardware items are supplied with the paging station:

- Black M6 thread-cutting screws, part no. 0383498N08 (qty. 8)
- Power supply power cables (ac and/or dc)

It is important to perform the procedures in the indicated sequence. ***The paging station weighs approximately 60 pounds. If possible, always use two persons to lift and handle the station.***

Remove the station from the packing kit. If the station is too heavy to lift from the packing carton, lighten the station by removing the power supply and power amplifier from the front of the station as follows:

– Remove Power Supply and Power Amplifier –

Step 1. Remove the two *TORX* screws holding the power supply using a *TORX* Screwdriver and TX15 bit.

Step 2. Remove the power supply and power amplifier from the chassis and set aside in a safe location.

Mounting Procedures (continued)

– *Remove Fan Door / Fan Shroud* –

Before the station can be installed in the equipment cabinet, the rear fan shroud must be temporarily removed. The following steps explain this procedure. Refer to Figure 4–9 (shown on next page) for locations of components called out in this procedure.

Step 1. Rotate the quarter-turn fasteners on the rear of the fan door *counterclockwise* to unlock the fan door.

Step 2. Open the fan door and disconnect the fan cable connector.

Step 3. Remove the fan door by lifting upward until it clears the hinge pins. Set the fan door aside in a safe place.

Step 4. If there is a peripheral bracket assembly installed in the duct, disconnect any cables that would inhibit its removal. Draw a diagram or tag the cables for later reconnection.

Step 5. Remove any installed peripheral bracket by removing two screws securing the bracket. Set screws and bracket aside for later reinstallation.

Step 6. Remove four black screws (two on each side) securing fan shroud to paging station chassis using a *TORX* screwdriver and TX30 bit. Set screws aside for later reinstallation.

Step 7. Remove the fan shroud from the station chassis by pulling straight outward. Remember the orientation of the shroud for later reinstallation.

– *Install Station in Cabinet* –

Step 1. Prepare the equipment cabinet rails for station installation by inserting one of the black screws (supplied) into each front rail at the lowermost hole that the station will occupy. Insert screws until the head is approximately 1/8-inch from the rail surface. These screws will assist in positioning and holding the station for mounting.

Step 2. Carefully lift the station and position it in the cabinet so that it is resting on the two screws installed in Step 1.

Step 3. Insert four (two on each side) of the supplied black M6 mounting screws, using a *TORX* screwdriver and TX30 bit. ***Do not*** install any screws within the area which will be occupied by the power amplifier when it is reinstalled. Tighten all mounting screws securely.

Step 4. Reinstall the rear fan shroud to the rear of the station chassis. Be sure all cables are clear before seating the shroud. Be sure door hinge pins are on the left side as viewed from the rear.

Step 5. Fasten the fan shroud duct to the cabinet rails using four of the supplied black M6 mounting screws. Tighten all screws securely.

IMPORTANT

To ensure proper cooling, locate the station within the cabinet so that that louvers in the cabinet rear door are aligned with the exhaust fans on the fan door.

If the station is installed in a non-Motorola cabinet, install the station so that the exhaust fans are aligned with louvers adequate to ensure proper cooling.

Mounting Procedures (continued)

IMPORTANT

Be sure to install the power supply assemblies in the same locations as when received.

Step 6. Reinstall the four black screws to secure the fan shroud to the paging station chassis. These screws were removed in Step 6 of ***Remove Fan Door / Fan Shroud.***

Step 7. Route the supplied power supply cables through the right side (viewed from rear) wiring access hole. Connect the power cables to the power supply ac power connectors.

Step 8. Route the rf antenna cable from the rf output connector through the left side wiring access hole.

Step 9. If peripheral bracket was removed, reinstall bracket and reconnect any cables which were disconnected. Secure bracket with screws removed in Step 5 of ***Remove Fan Door / Fan Shroud.***

Step 10. Reinstall fan door on hinge pins and reconnect fan cable. Check to be sure all internal connections are completed.

Step 11. Close fan door and secure by pushing inward on two quarter-turn fasteners while rotating *clockwise*.

Step 12. Reinstall the power supply ***in the original location*** and secure with original *TORX* screws.

Step 13. Remove two installation aid screws installed in Step 1.

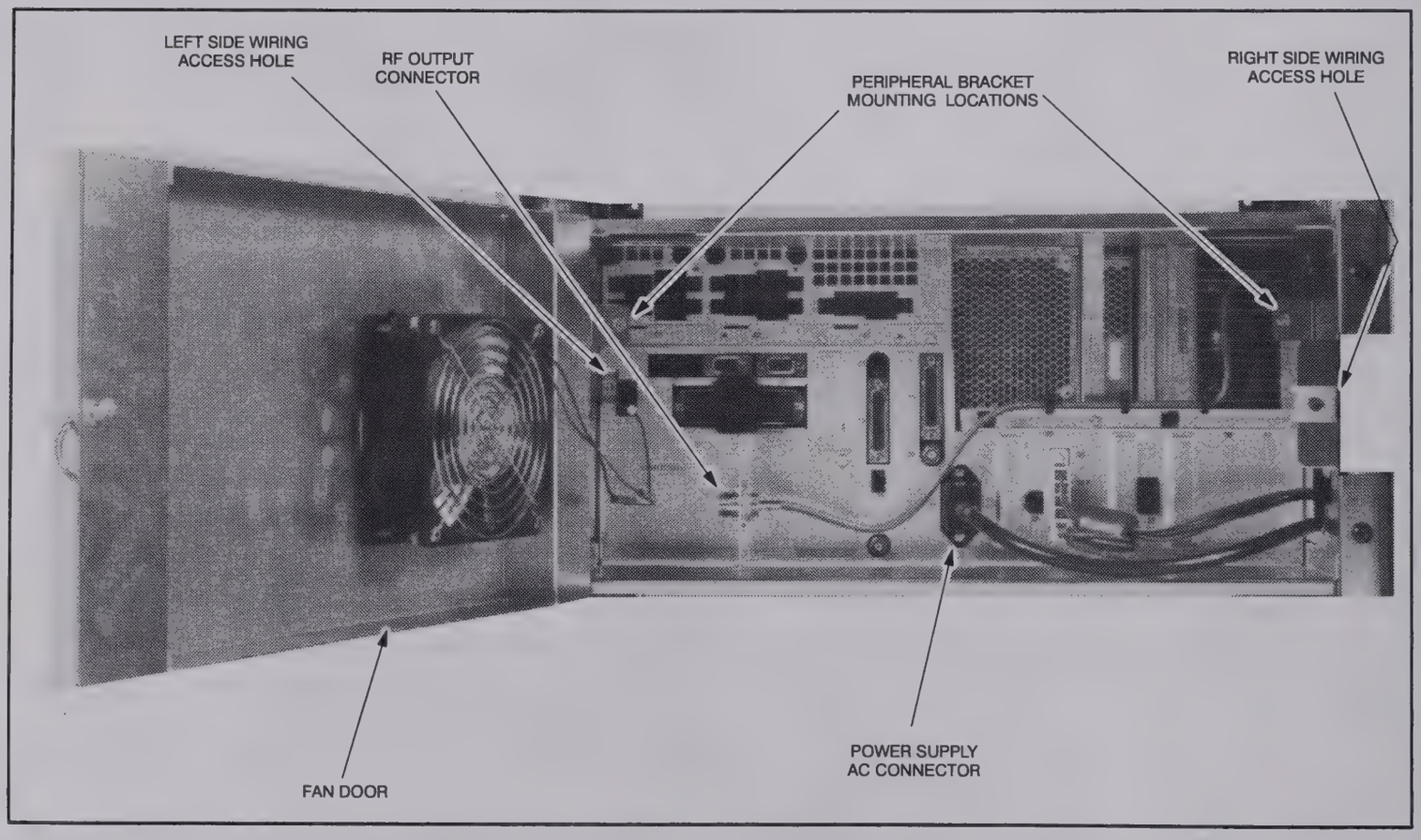


Figure 4–9. Nucleus *Standard Power Station with Fan Shroud Installed – Rear View*

Mounting Procedures (continued)

WARNING

Any deviation from this procedure may cause injury to the installer or damage to the equipment. Read the entire procedure and understand the installation sequence before beginning the procedure.

IMPORTANT

Identify the location of each power supply before removing. When reinstalling, the power supplies must be returned to the same location as when the station was received.

Mounting the High Power Station in an EIA Standard 19″ Panel Width Motorola Cabinet

The following tools are required to perform this installation procedure:

- *TORX* screwdriver, with TX15 and TX30 bits
- Small adjustable wrench or gas pliers
- Wire cutters (for cutting tie-wraps)

The following hardware items are supplied with the paging station:

- Black M6 thread-cutting screws, part no. 0383498N08 (qty. 16)
- Power supply power cables (ac and/or dc)

It is important to perform the procedures in the indicated sequence. ***The paging station weighs approximately 105 pounds. If possible, always use two persons to lift and handle the station.***

Remove the station from the packing kit. If the station is too heavy to lift from the packing carton, lighten the station by removing the two power supply assemblies and the power amplifier from the front of the station as follows:

– Remove Power Supplies –

Step 1. Remove the two *TORX* screws holding each power supply using a *TORX* Screwdriver and TX15 bit.

Step 2. Remove the power supplies from the chassis and set aside in a safe location.

Removal of the power amplifier assembly will further lighten the station to facilitate lifting and installing the station in the equipment cabinet. Remove the power amplifier assembly as shown in the following steps.

– Remove Power Amplifier –

Step 1. Place the paging station on a clean work surface.

Step 2. Remove and discard the two shipping screws securing the power amplifier assembly. Use a *TORX* Screwdriver with TX30 bit and a small wrench or pliers to hold the nut.

Step 3. Pull the power amplifier out from the chassis approximately 5 inches.

Step 4. Disconnect the rf cable located at the right front of the power amplifier.

Step 5. Withdraw the power amplifier the rest of the way from the chassis and set aside in a safe location.

Mounting Procedures (continued)

– *Remove Fan Door / Fan Shroud* –

Before the station can be installed in the equipment cabinet, the rear fan shroud must be temporarily removed. The following steps explain this procedure. Refer to Figure 4–10 (shown on next page) for locations of components called out in this procedure.

Step 1. Rotate the two quarter-turn fasteners on the rear of the fan door *counterclockwise* to unlock the fan door.

Step 2. Open the fan door and disconnect the fan cable connector.

Step 3. Remove the fan door by lifting upward until it clears the hinge pins. Set the fan door aside in a safe place.

Step 4. If there is a peripheral bracket assembly installed in the duct, disconnect any cables that would inhibit its removal. Draw a diagram or tag the cables for later reconnection.

Step 5. Remove any installed peripheral bracket by removing two screws securing the bracket. Set screws and bracket aside for later reinstallation.

Step 6. Remove four black screws (two on each side) securing fan shroud to paging station chassis using a *TORX* screwdriver and TX30 bit. Set screws aside for later reinstallation.

Step 7. Remove the fan shroud from the station chassis by pulling straight outward. Remember the orientation of the shroud for later reinstallation.

– *Install Station in Cabinet* –

Step 1. Prepare the equipment cabinet rails for station installation by inserting one of the black screws (supplied) into each front rail at the lowermost hole that the station will occupy. Insert screws until the head is approximately 1/8-inch from the rail surface. These screws will assist in positioning and holding the station for mounting.

Step 2. Carefully lift the station and position it in the cabinet so that it is resting on the two screws installed in Step 1.

Step 3. Insert four (two on each side) of the supplied black M6 mounting screws, using a *TORX* screwdriver and TX30 bit. ***Do not*** install any screws within the area which will be occupied by the power amplifier when it is reinstalled. Tighten all mounting screws securely.

Step 4. Reinstall the rear fan shroud to the rear of the station chassis. Be sure all cables are clear before seating the shroud. Be sure door hinge pins are on the left side as viewed from the rear.

Step 5. Fasten the fan shroud duct to the cabinet rails using four of the supplied black M6 mounting screws. Tighten all screws securely.

Step 6. Reinstall the four black screws to secure the fan shroud to the paging station chassis. These screws were removed in Step 6 of ***Remove Fan Door / Fan Shroud.***

IMPORTANT

To ensure proper cooling, locate the station within the cabinet so that that louvers in the cabinet rear door are aligned with the exhaust fans on the fan door.

If the station is installed in a non-Motorola cabinet, install the station so that the exhaust fans are aligned with louvers adequate to ensure proper cooling.

Mounting Procedures (continued)

Step 7. Route the supplied power supply cables through the right side (viewed from rear) wiring access hole. Connect the power cables to the power supply ac power connectors.

Step 8. Route the rf antenna cable from the rf output connector through the left side wiring access hole.

Step 9. If peripheral bracket was removed, reinstall bracket and reconnect any cables which were disconnected. Secure bracket with screws removed in Step 5 of ***Remove Fan Door / Fan Shroud.***

Step 10. Reinstall fan door on hinge pins and reconnect fan cable. Check to be sure all internal connections are completed.

Step 11. Close fan door and secure by pushing inward on two quarter-turn fasteners while rotating *clockwise.*

Step 12. Reinstall power amplifier assembly in chassis. Push inward far enough to reconnect rf cable at lower right side. Reconnect cable, then carefully push inward until seated Secure to chassis and frame using four supplied black M6 screws.

Step 13. Reinstall two power supply assemblies ***in the original location*** and secure with original *TORX* screws.

Step 14. Remove two installation aid screws installed in Step 1.

IMPORTANT

Be sure to install the power supply assemblies in the same locations as when received.

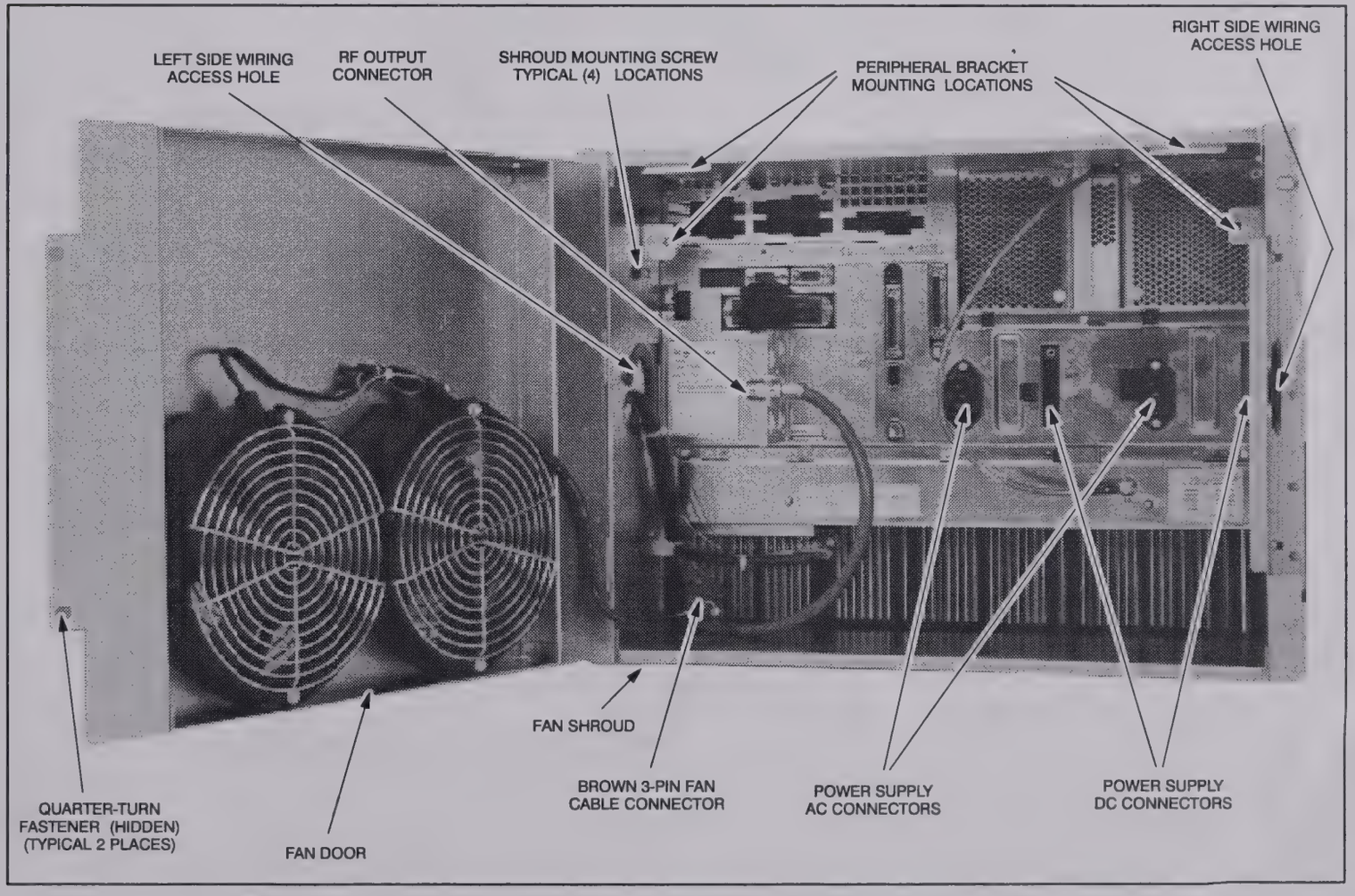
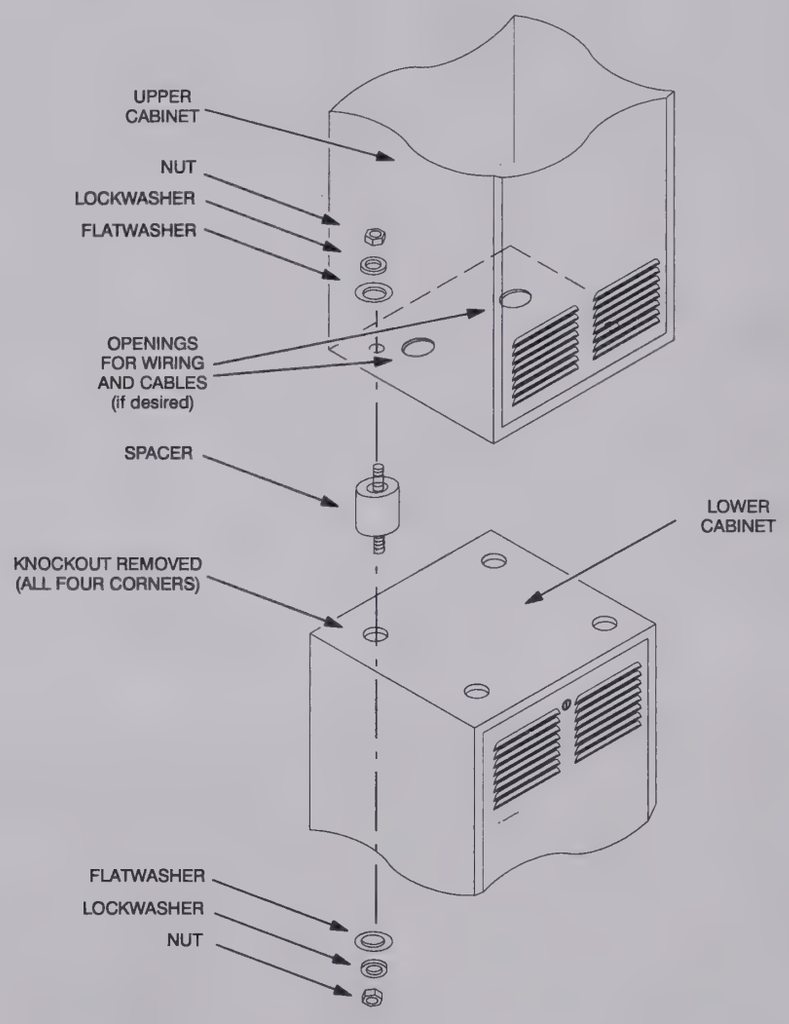


Figure 4–10. Nucleus *High Power Station with Fan Shroud Installed – Rear View*

Stacking Cabinets

The 25″ and 46″ cabinets may be stacked to maximize use of site space. Stacking kit TRN7750 contains the necessary bolts, nuts, and washers to stack one cabinet on another. Remove the knockouts on the top of the lower cabinet and use the hardware as shown below to attach the upper cabinet.



The following table lists the stacking limits for the available cabinet sizes. ***If you are stacking a 25″ cabinet with a 46″ cabinet, place the 46″ cabinet on the bottom.***

Cabinet Stacking Limits

Cabinet Size	Maximum Stacking Number
25″	3 (75″ max height)
46″	2 (92″ max height)

5 CONNECTOR PINOUTS

The *Nucleus* Paging Station Backplane (at the rear of the station) provides the station interface connectors for power, paging data, rf, and diagnostics. Each connector's assigned number is stamped (without the "J" prefix) into the metal shield covering the Backplane board.

Figure 5–1 shows the location of the Backplane connectors. Pin-out tables follow.

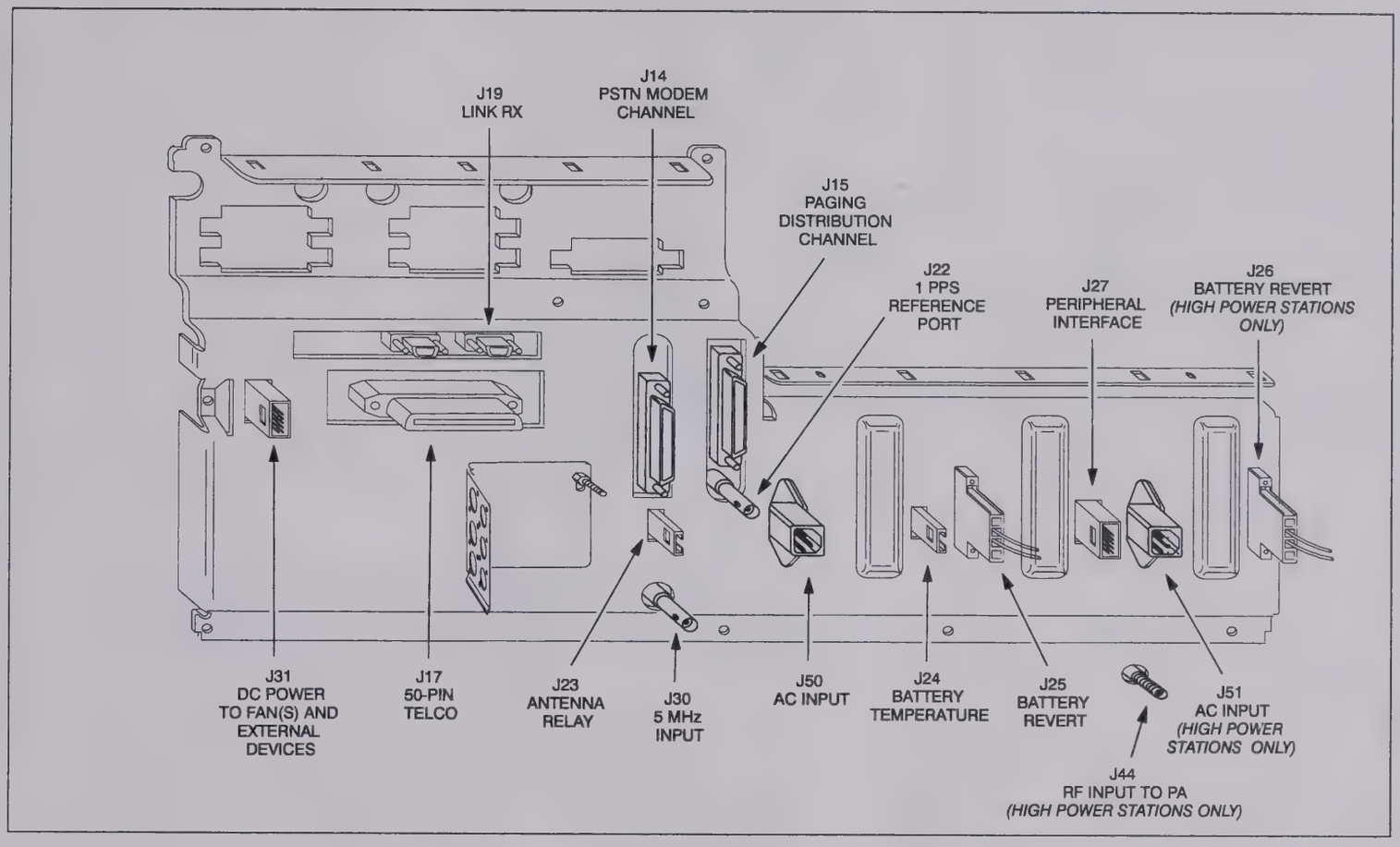


Figure 5–1. *Location of Backplane Connectors*

Connector Pinouts (continued)

In these pin-out tables, each connector pin is defined by signal name, input or output, and a brief description of the signal function.

J14 (DB-25, RS-232) PSTN MODEM CHANNEL

Pin #	Signal	Input	Output	Function
1	GND		✓	Ground
2	PSTN TXD		✓	PSTN Transmit Data
3	PSTN RXD	✓		PSTN Receive Data
4	PSTN RTS		✓	PSTN Request to Send
5	PSTN CTS	✓		PSTN Clear to Send
6	PSTN DSR	✓		PSTN Data Set Ready
7	GND		✓	Ground
8	PSTN DCD	✓		PSTN Data Carrier Det.
9	Open			
10	Open			
11	Open			
12	Open			
13	Open			
14	Open			
15	PSTN TCLK		✓	PSTN Transmit Clock
16	Open			
17	PSTN RCLK	✓		PSTN Receive Clock
18	Open			
19	Open			
20	PSTN DTR		✓	PSTN Data Term. Ready
21	Open			
22	PSTN RI	✓		PSTN Ring Indicate
23	Open			
24	Open			
25	Open			

Do not use connector J14 if the *Nucleus* station has an Internal NIU; connections to the optional dial modem on the Internal NIU are made through connector J17, pins 5 and 30.

J15 (DB-25, RS-232) PAGING DISTRIBUTION CHANNEL

Pin #	Signal	Input	Output	Function
1	GND		✓	Ground
2	Dist TXDA		✓	Dist. Transmit Data A
3	Dist RXDA	✓		Dist. Receive Data A
4	Dist RTS		✓	Dist. Request to Send
5	Dist CTS	✓		Dist. Clear to Send
6	Dist DSR	✓		Dist. Data Set Ready
7	GND		✓	Ground
8	Dist DCD	✓		Dist. Data Carrier Detect
9	Open			
10	Open			
11	Open			
12	Open			
13	Dist RCLKB	✓		Dist. Receive Clock B
14	Dist TXDB		✓	Dist. Transmit Data B
15	Dist TCLKA		✓	Dist. Transmit Clock A
16	Dist RXDB	✓		Dist. Receive Data B
17	Dist RCLKA	✓		Dist. Receive Clock A
18	Open			
19	Dist TCLKB		✓	Dist. Transmit Clock B
20	Dist DTR		✓	Dist. Data Term. Ready
21	Open			
22	Open			
23	Open			
24	Open			
25	Open			

Connector Pinouts (continued)

J17 — SYSTEM 50-PIN TELCO

Punch Block Pair #		J17 Pin #	Wire Color Main / Trace	Signal	Function
1	Tip	26	White / Blue	Open	Open
	Ring	1	Blue / White	Aux Audio In	Auxiliary Audio Input
2	Tip	27	White / Orange	Relay N.O.	Relay #1 Normally Open
	Ring	2	Orange / White	Relay N.C.	Relay #1 Normally Closed
3	Tip	28	White / Green	Line 1 —	Line 1 Negative Input
	Ring	3	Green/ White	Line 1+	Line 1 Positive Input
4	Tip	29	White / Brown	Line 2 —	Line 2 Negative Output
	Ring	4	Brown / White	Line 2+	Line 2 Positive Output
5	Tip	30	White / Slate	Dial Modem —	Dial-up (PSTN) Modem Connection
	Ring	5	Slate / White	Dial Modem +	Dial-up (PSTN) Modem Connection
6	Tip	31	Red / Blue	Open	Open
	Ring	6	Blue / Red	Open	Open
7	Tip	32	Red / Orange	GND	Ground
	Ring	7	Orange / Red	GND	Ground
8	Tip	33	Red / Green	13.8 V DC	+13.8 V dc from Power Supply
	Ring	8	Green / Red	5 V DC	+5 V dc from Power Supply
9	Tip	34	Red / Brown	GND	Ground
	Ring	9	Brown / Red	Buffered Audio Out	Buffered Audio Output
10	Tip	35	Red / Slate	Ext Mode Req	External Mode Request
	Ring	10	Slate / Red	Ext Key Req	External Key Request
11	Tip	36	Black / Blue	WC Out 1	Auxiliary Output #1 (Internal NIU*)
	Ring	11	Blue / Black	WC In 1	External Alarm #1 + (Internal NIU*)
12	Tip	37	Black / Orange	WC Out 2	Auxiliary Output #2 (Internal NIU*)
	Ring	12	Orange / Black	WC In 2	External Alarm #1 — (Internal NIU*)
13	Tip	38	Black / Green	WC Out 3	Auxiliary Relay Control (Internal NIU*)
	Ring	13	Green / Black	Open	Open
14	Tip	39	Black / Brown	WC Out 4	(not used with Internal NIU*)
	Ring	14	Brown / Black	NIU Line +	Wireline Paging Input +
15	Tip	40	Black Slate	WC Out 5	Relay #2 Common (Internal NIU*)
	Ring	15	Slack / Black	NIU Line —	Wireline Paging Input —
16	Tip	41	Yellow / Blue	WC Out 6	Relay #2 N.O. (Internal NIU*)
	Ring	16	Blue / Yellow	WC In 6	(not used with Internal NIU*)
17	Tip	42	Yellow / Orange	WC In 8	(not used with Internal NIU*)
	Ring	17	Orange / Yellow	Open	Open
18	Tip	43	Yellow / Green	WC Out 7	Relay #2 N.C. (Internal NIU*)
	Ring	18	Green / Yellow	*FLEX*/ERMES Select	*FLEX*/ERMES Function Select Line
19	Tip	44	Yellow / Brown	WC Out 8	(not used with Internal NIU*)
	Ring	19	Brown / Yellow	TX Baud Clk	Transmit Baud Clock
20	Tip	45	Yellow / Slate	WC In 5	(not used with Internal NIU*)
	Ring	20	Slate / Yellow	TX Data Clk	Transmit Data Clock
21	Tip	46	Violet / Blue	Ext Mon Rx Sq Ind	External Monitor Receiver Squelch Ind.
	Ring	21	Blue / Violet	TX Data	Transmit Data
22	Tip	47	Violet / Orange	Monitor Rx Audio	Internal or External Monitor Rx Audio**
	Ring	22	Orange / Violet	WC In 4	External Alarm #2 — (Internal NIU*)
23	Tip	48	Violet / Green	Open	Open
	Ring	23	Green / Violet	WC In 3	External Alarm #2 + (Internal NIU*)
24	Tip	49	Violet / Brown	Relay Common	Relay #1 Common
	Ring	24	Brown / Violet	Ext Monitor Rx Dis	External Monitor Receiver Disable
25	Tip	50	Violet / Slate	Ext Monitor Rx DPL En	External Monitor Rx DPL Enable
	Ring	25	Slate / Violet	WC In 7	(not used with Internal NIU*)

*These pins carry Wildcard Inputs and Outputs (as indicated by the Signal name) if there is no Internal NIU.

**Input if Receiver Module is configured as a link receiver, or as "no internal".
Output if Receiver Module is configured as a monitor receiver.

Connector Pinouts (continued)

J19 (DB-9) LINK RX

Pin #	Signal	Input	Output	Function
1	GND		✓	Ground
2	Ext Link Rx DPL En	✓		Ext link Rx DPL Enable
3	Ext Link Rx Sq Ind	✓		Ext link Rx Squelch Ind
4	Ext Link Rx DPL Ind	✓		Ext link Rx DPL Det. Ind
5	Link Rx Audio	*	*	Int or Ext Link Rx Audio
6	Open			Open
7	Open			Open
8	Open			Open
9	13.8 V		✓	13.8 V dc from Power Supply

*Input if Receiver Module is configured as a monitor receiver, or as "no internal".
Output if Receiver Module is configured as a link receiver.

J22 (BNC) 1 PPS REFERENCE PORT

J23 (AMP-MODU) ANTENNA RELAY

Pin #	Signal	Input	Output	Function
1	GND		✓	Ground
2	ANT RLY KEYED A+		✓	Switched +14.2 V to energize antenna relay
3	GND		✓	Ground

J24 (AMP-MODU) BATTERY TEMPERATURE

PIN #	Signal	Input	Output	Function
1	GND		✓	Ground
2	BATT TEMP	✓		Variable resistance proportional to battery temp. from sensor near storage batteries
3	GND		✓	Ground

J25 (41-PIN MODULAR) BATTERY REVERT

J26 (41-PIN MODULAR) BATTERY REVERT

RED (top) and BLACK (bottom) wires to external battery.

Connector Pinouts (continued)

J27 (AMP-MODU) — PERIPHERAL INTERFACE

Pin #	Signal	Input	Output	Function
1	GND		✓	Ground
2	EXT WM Vf	✓		DC voltage prop. to Ext. Wattmeter forward power
3	EXT WM Vr	✓		DC voltage prop. to Ext. Wattmeter reflected power
4	EXT WM Ref	✓		Ground reference for External Wattmeter
5	EXT Circ Temp	✓		DC voltage prop. to temp. from sensor on Circulator
6	EXT Mon Volt. 1		✓	Sw. +14.2 V to energize Main/Standby relay
7	EXT I/O 2	✓		Future Use
8	ANT RLY KEYED A+		✓	Sw. +14.2 V to energize Antenna Relay
9	GND		✓	Ground
10	13.8 V dc		✓	+13.8 V dc from Power Supply

J30 (BNC) — 5 MHz INPUT

Accepts external 5 MHz frequency standard for calibrating station reference oscillator (UHSO or HSO); 5 MHz injection level = 1.0 ± 0.5 V RMS

J31 (AMP-MODU) — DC POWER TO FAN(S) AND EXTERNAL DEVICES

Pin #	Signal	Input	Output	Function
1	GND		✓	Ground
2	GND		✓	Ground
3	5 Vdc		✓	+5 V dc from Power Supply
4	5 Vdc		✓	+5 V dc from Power Supply
5	13.8 Vdc		✓	+13.8 V dc from Power Supply
6	13.8 Vdc		✓	+13.8 V dc from Power Supply
7	28 Vdc		✓	+28 V dc from Power Supply
8	GND		✓	Ground
9	28 V dc		✓	+28 V dc from Power Supply
10	GND		✓	Ground

The *Nucleus* station is shipped with a connector-cable assembly plugged into connector J31 (refer to Figure 5−2). Two wires provide dc power to the fan(s) in the rear door. The other two wires terminate in a connector that allows a satellite receiver to connect for 28 V dc power supply from the *Nucleus* station.

J44 (BLINDMATE SMA) — RF INPUT TO PA (FROM EXCITER)

Passes rf from Exciter Module into PA Module (High Power Stations only).

J50 (3-PRONG RECEPTACLE) — AC INPUT

J51 (3-PRONG RECEPTACLE) — AC INPUT

Connects to 110 V / 220 V ac source via 3-wire cord. (J51 present in High Power Stations only.)

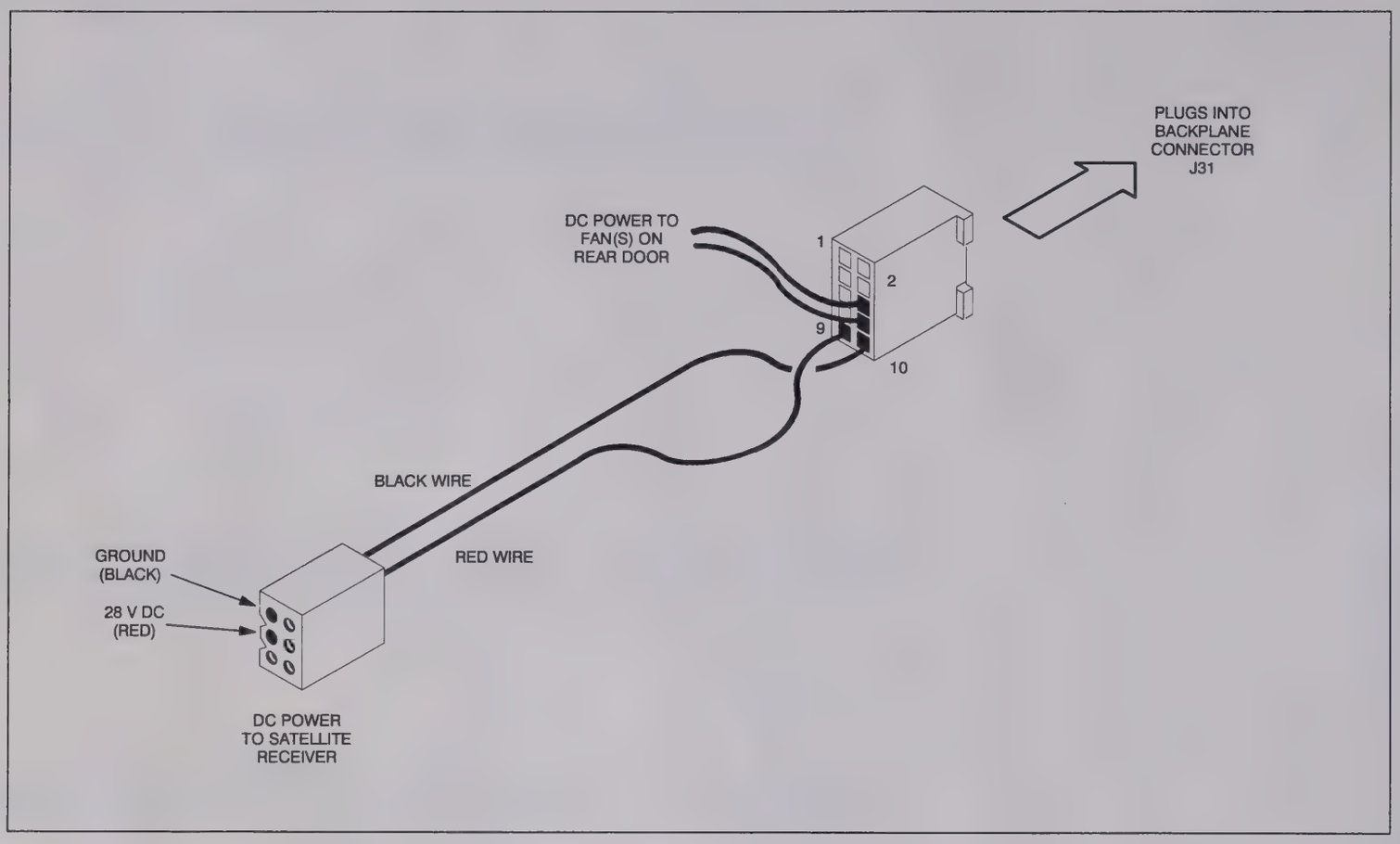


Figure 5–2. *Satellite Receiver DC Power Connector*

6 POWER SUPPLY CONNECTIONS

Ground Connection

The *Nucleus* station cage is equipped with a single ground lug located on the rear panel of the cage. Connect this lug to the site ground point as shown in Figure 6−1.

Refer to the following manual for complete information regarding lightning protection:

Quality Standards − FNE Installation Manual R56
(Motorola part number 68P81089E50)

This manual can be ordered from the Motorola Parts Division at (800) 422-4210.

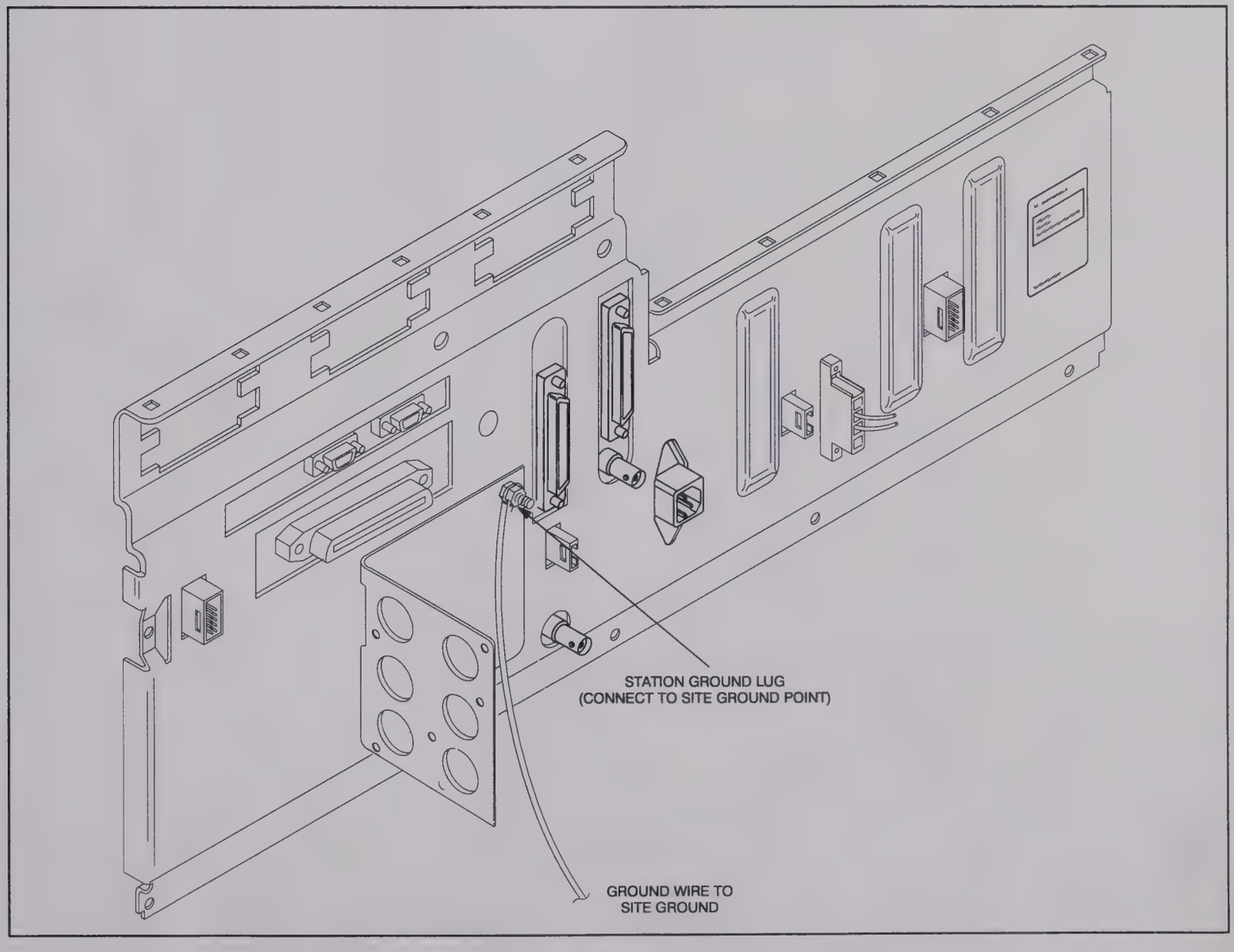


Figure 6−1. *Connecting Station Ground Lug to Site Ground*

AC Input Power Connection

CAUTION

Do not apply ac power to the station at this time. Make sure that the Power Supply Module On/Off switch(es) located on the front panel is turned to **OFF** (down) *and* that the circuit breaker associated with the ac outlet is also turned to **OFF**.

Each ac station is shipped with the type of ac power line cord specified by customer order. Standard-power stations are supplied with one cord, high-power stations are supplied with two cords. The receptacle end of the cord is factory-installed in Backplane connector J50 as shown in Figure 6–2. For high-power stations, the receptacle end of the second cord is factory-installed in connector J51.

Connect the plug end of each cord into a grounded outlet. If you ordered the unterminated cord option (X192), you must obtain a suitable plug from an electrical parts supplier and install it on the unterminated end of the cord.

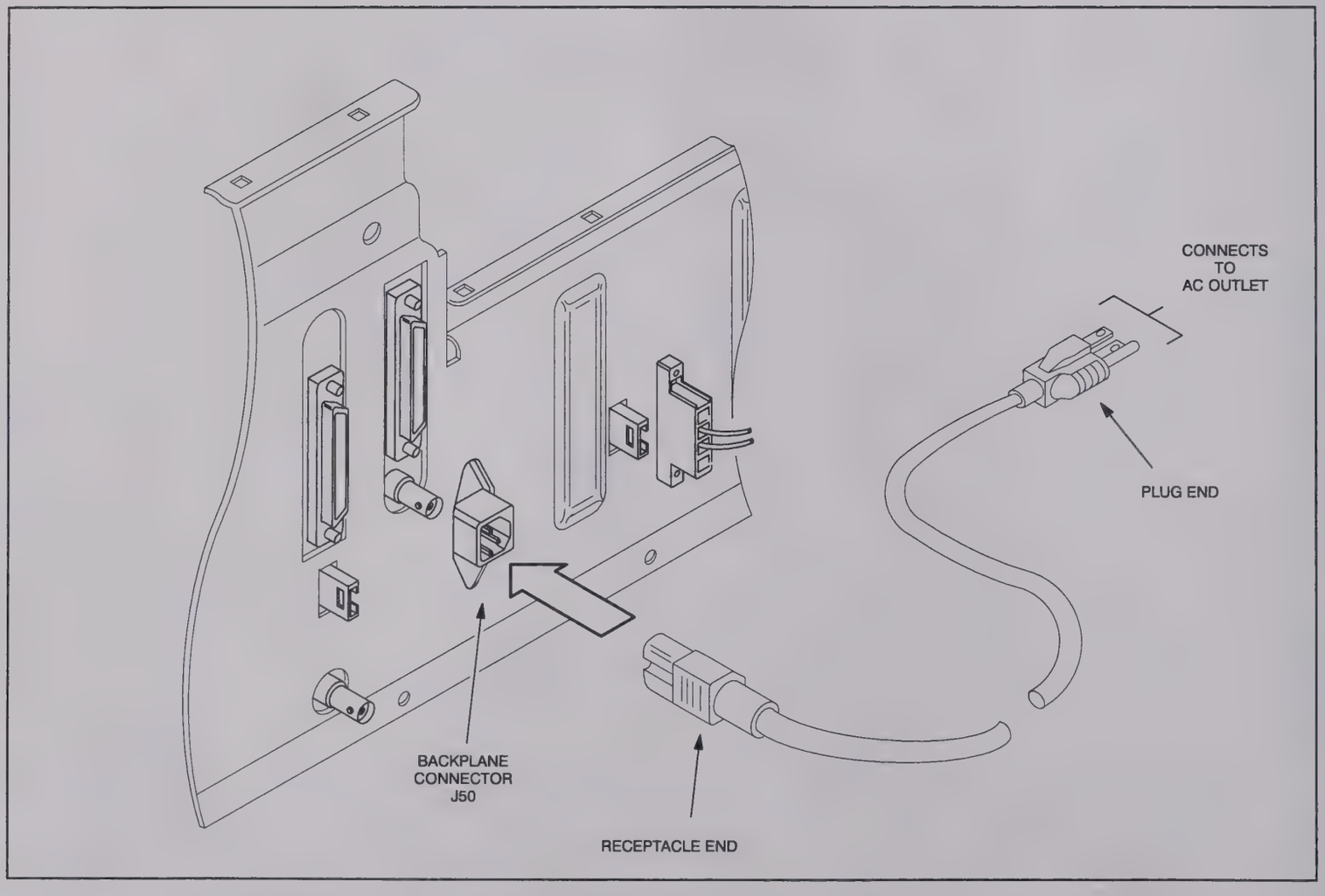


Figure 6–2. *Connecting AC Line Cord (U.S. 120 V AC Line Cord Shown)*

Control-Only Battery Revert Connection (Option X30)

Stations ordered with Option X30 revert to battery backup to maintain power to the Station Control Module in the event of an ac power failure. This retains station memory and continues communications with the paging system control point.

The station is shipped with a 2-wire cable with two 10-foot lengths of red and black #8 AWG gauge wire and a fuse block with 20 A fuse. Connections are made in the factory as shown in Figure 6–3.

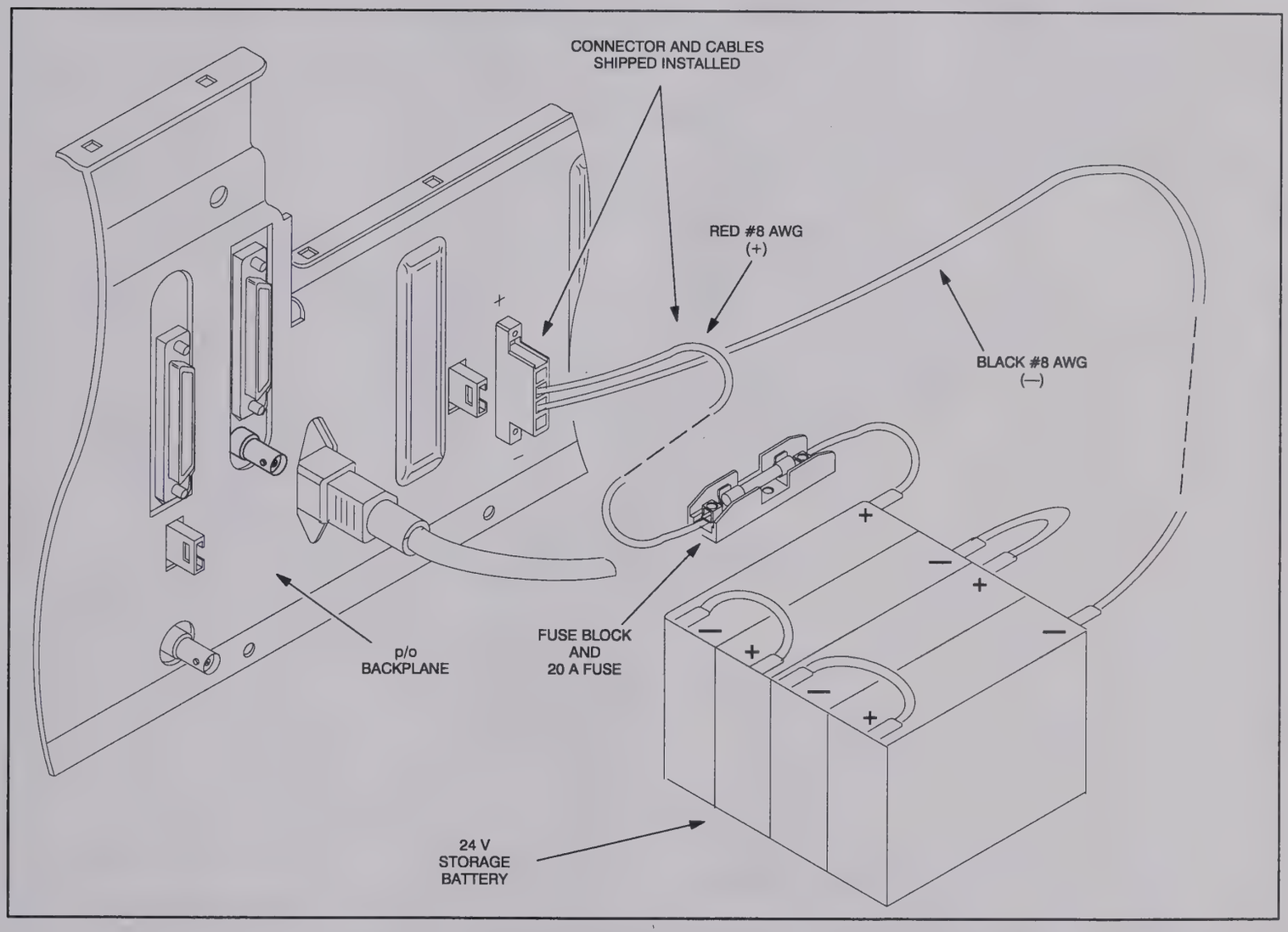


Figure 6–3. *Connections for Control-Only Battery Revert Option*

Station Battery Revert Connection (Option X43)

Stations ordered with Option X43 revert to battery backup power for station operation in the event of an ac power failure. The station continues to key during battery revert, while final power output is reduced by a user-input fixed cutback reduction percentage. Batteries are ***not*** included with the station.

This option is available for standard power stations only.

Make connections to the battery/batteries as shown in Figure 6–4.

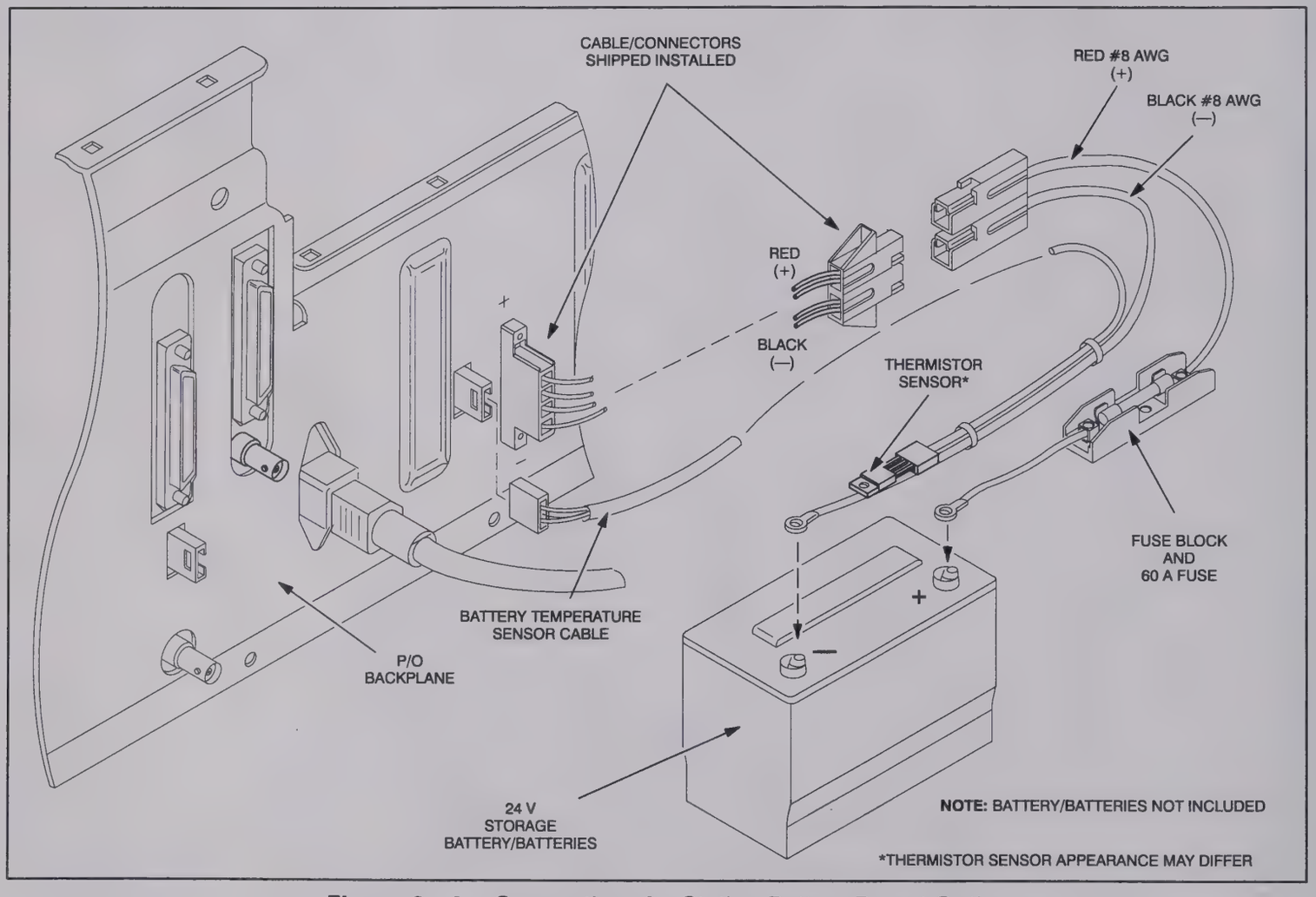


Figure 6–4. *Connections for Station Battery Revert Option*

DC Power Supply Connection (Option X342 and Option X581)

Stations ordered with Option X342 or Option X581 operate on dc power according to the following specifications:

Option	Input Voltage	Input Current	Recommended Circuit Breaker/Fuse
X342	21 – 34.5 V dc	40 A maximum	50 A
X581	41 – 72 V dc	18 A maximum	25 A

Make connections as shown in Figure 6–5, Figure 6–6, and Figure 6–7.

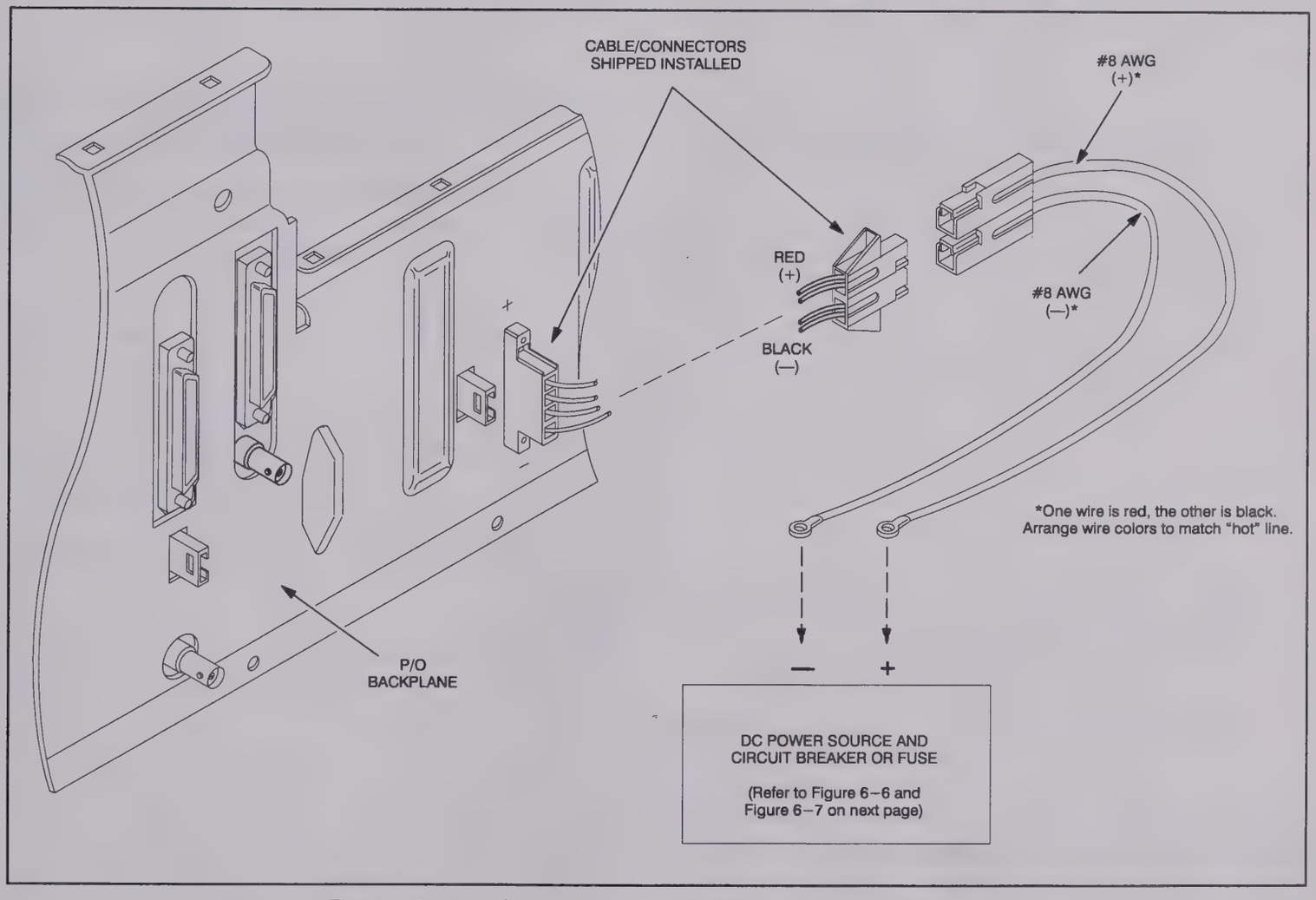


Figure 6–5. *Connections for DC Power Supply Options*

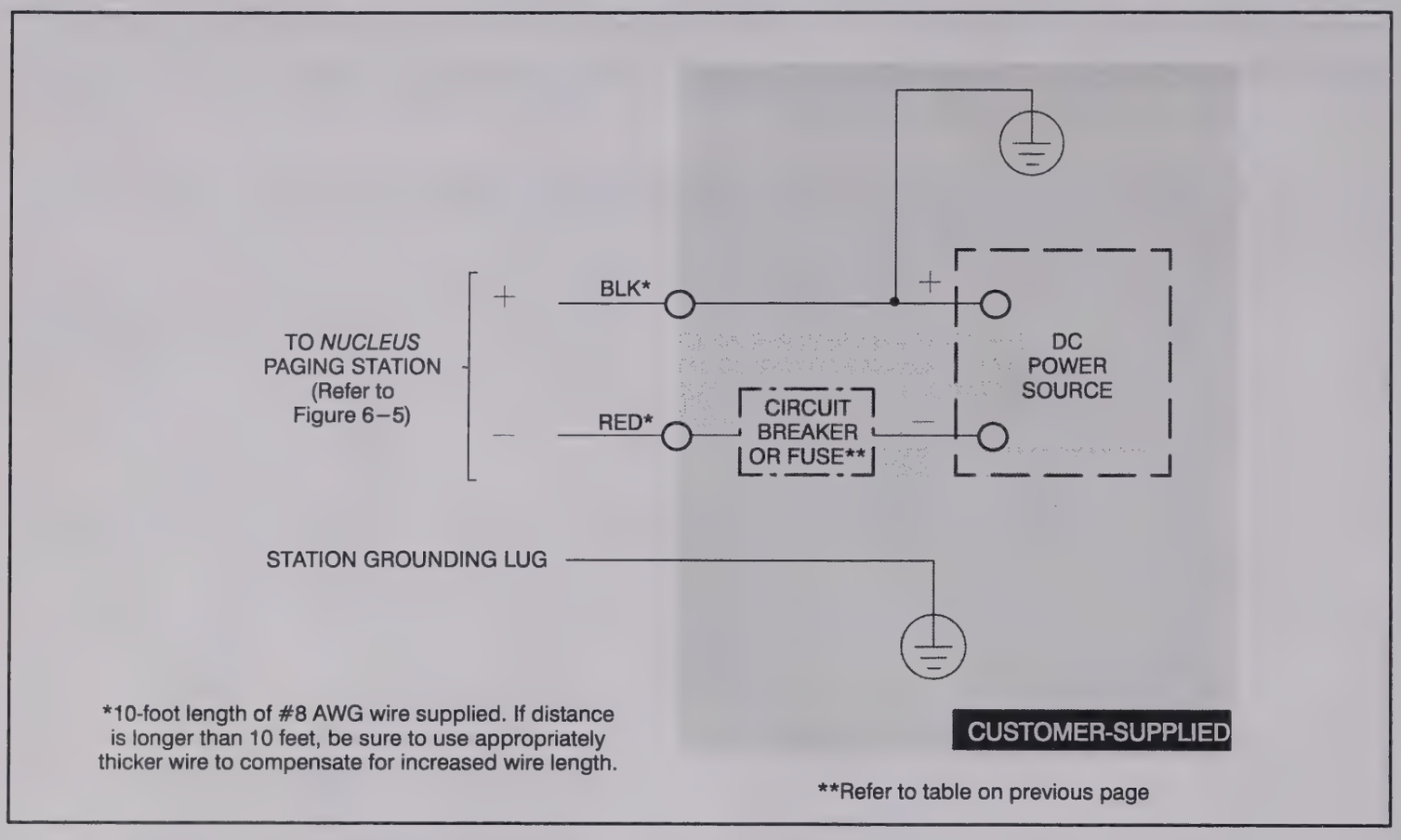


Figure 6–6. *Connections for Negative Voltage DC Power Supply (for example, –48 V DC)*

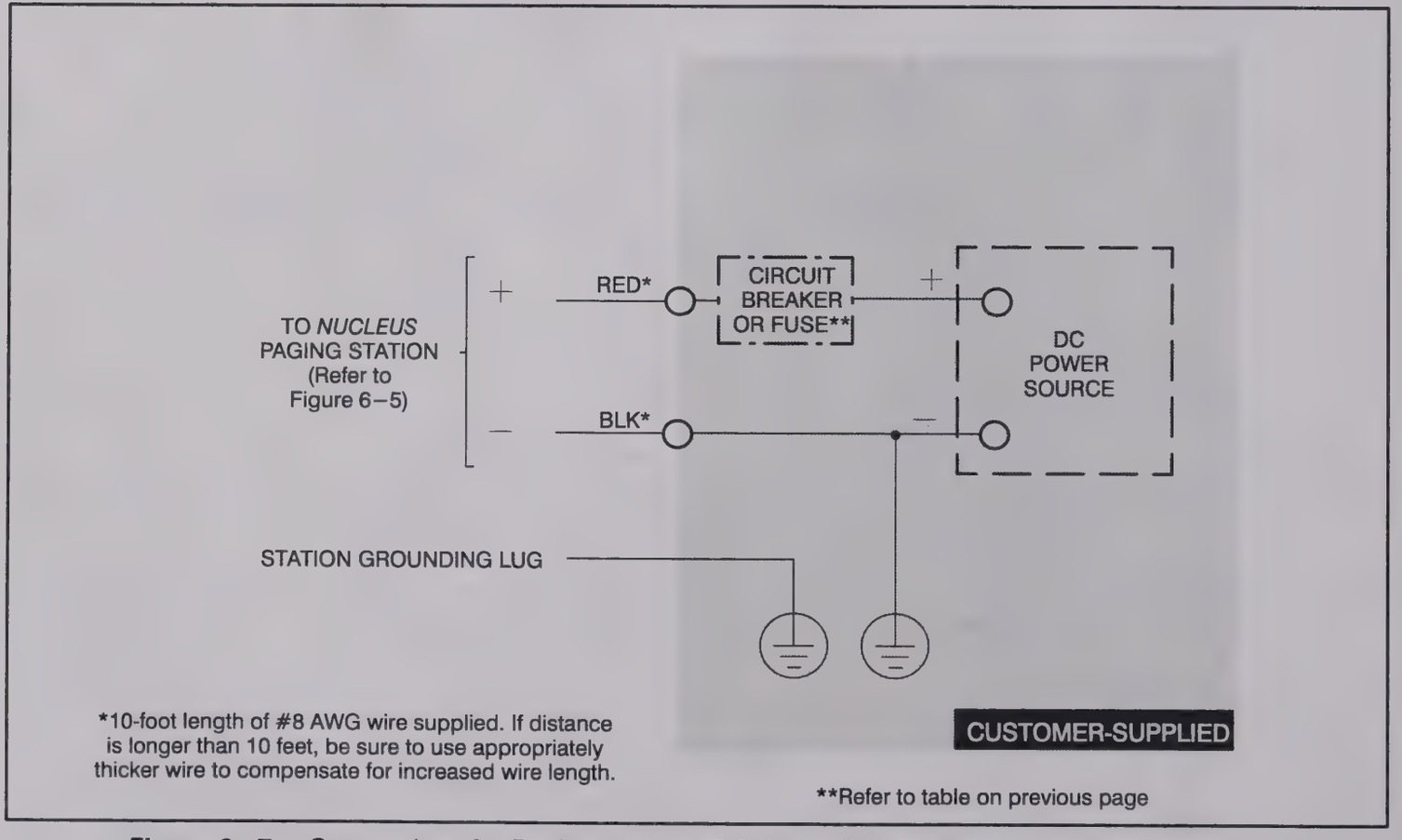


Figure 6–7. *Connections for Positive Voltage DC Power Supply (for example, +24 V DC)*

7 PAGING DATA INPUT CONNECTIONS

This section provides procedures for interfacing paging data inputs to the *Nucleus* Paging Station Internal NIU via the station Backplane. ***If your station does not have an Internal NIU, skip this section.***

Modem Requirements

The Option X443 Link Modem (QAM) is required with the Internal NIU when the paging data input is from a wireline interface, analog satellite downlink, internal link receiver, or external link receiver.

No modem is required for digital satellite downlink paging data input.

If your station was ordered with Option X443, the Link Modem is factory-installed on the Internal NIU board. For field-installation of the Link Modem, see Section 19 – *Module Replacement Procedures*. To order the Link Modem for field installation, order kit number TRN7994.

Wireline
(requires Link Modem Option X443)

For wireline paging data input, make connections as follows:

Step 1. Connect telephone line **tip** to station Backplane connector J17, pair 14, ring conductor (pin 14) (NIU Line +).

Step 2. Connect telephone line **ring** to station Backplane connector J17, pair 15, ring conductor (pin 15) (NIU Line –).

External Analog Link Receiver
(requires Link Modem Option X443)

If an external analog link receiver is used, connect the receiver using the following procedure. ***(If your station was ordered with an External Link Receiver option, a cable is provided which completes the necessary connections between the receiver and Backplane connector J19.)***

Step 1. Connect link receiver **audio** line to station Backplane connector J19, pin 5 (Link Rx Audio).

Step 2. Connect link receiver **squelch** line (if applicable) to station Backplane connector J19, pin 3 (Ext Link Rx Sq Ind).

Step 3. Connect link receiver **ground** line to station Backplane connector J19, pin 1 (Ground).

External Digital Satellite Downlink Receiver

(no modem required)

If an external digital satellite downlink receiver is used, connect the receiver as follows:

Step 1. Connect **data** line to station Backplane connector J15 pin 3 (Dist RXDA).

Step 2. Connect **clock** line to station Backplane connector J15, pin 17 (Dist RCLKA).

Step 3. Connect **ground** line to station Backplane connector J15, pin 7 (Ground).

Step 4. If satellite receiver squelch/carrier detect is desired, connect receiver **squelch** line to station Backplane connector J19, pin 3 (External Link Rx Squelch Ind).

8 RF CONNECTIONS

Introduction

If the station requires both a transmit antenna and a receive antenna, the rf cabling to/from the antennas may be connected either separately or through a single connection with an antenna relay (Option X371).

Separate Rx and Tx Antennas

Stations intended for separate transmit and receive antennas are shipped with the coaxial cables from the Power Amplifier Module and to the Receiver Module connected to the antenna bracket on the Backplane. The antenna bracket has two rows of three holes each. The inner row is for the receive antennas while the center position of the outer row is for the transmit antenna. Connect the rf cables from the transmit and receive antennas to the N-type female connectors on the bracket as shown in Figure 8–1.

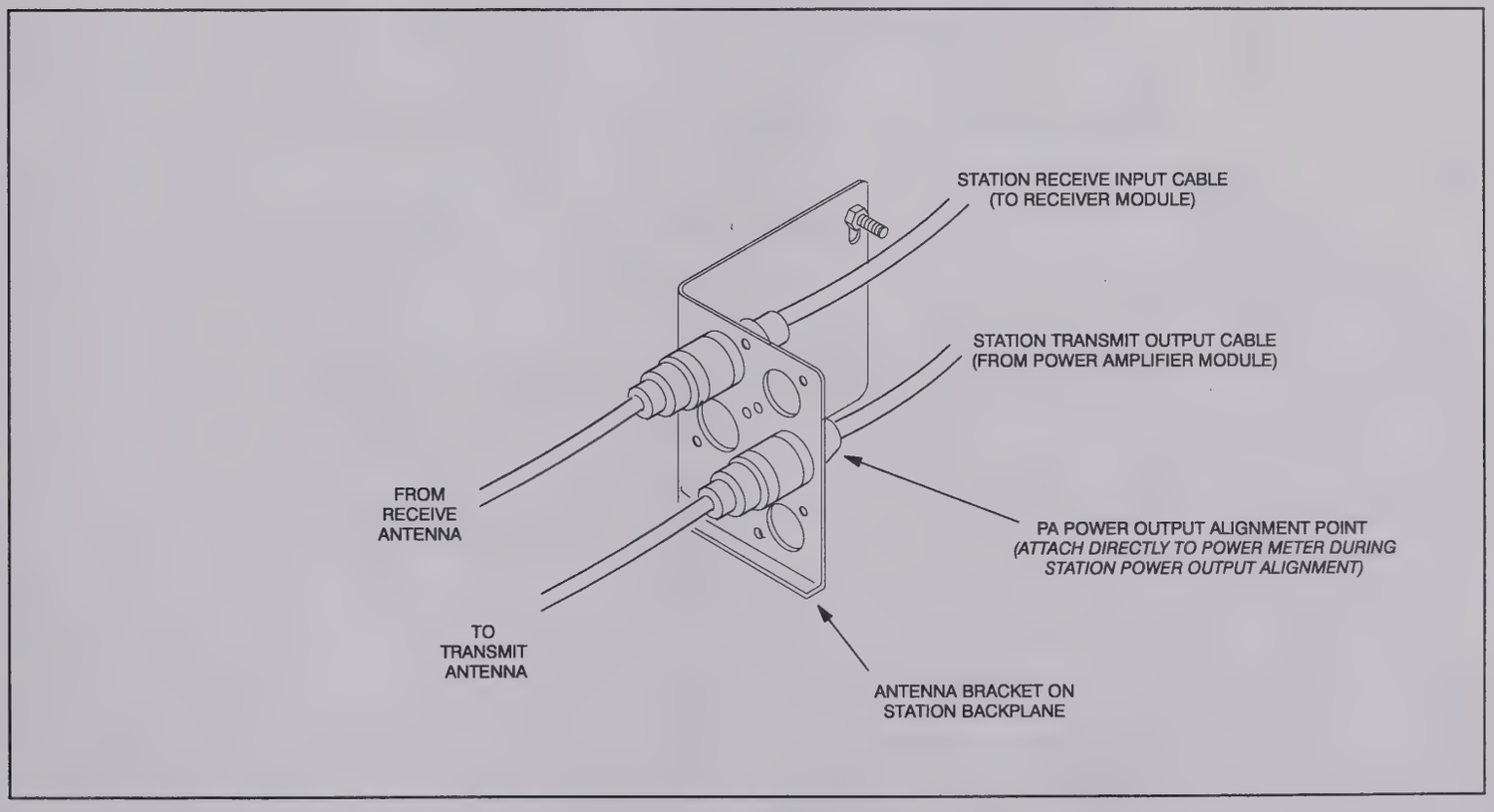


Figure 8–1. *Backplane Connections for Separate RX and TX Antennas*

Antenna Relay (Option X371)

The antenna relay option allows a single antenna to be used for both transmit and receive operation. Stations equipped with the antenna relay option are shipped with the antenna relay module installed in the antenna bracket on the station Backplane, and with the rf cables from the Power Amplifier Module and to the Receiver Module connected as shown in Figure 8–2. A single N-type connector in the center is provided for connection to a single Tx/Rx antenna. The antenna relay module is controlled by a signal from the Station Control Module via a three-wire cable connected between the antenna relay module and Connector J23 on the Backplane.

Connect the single transmit/receive antenna rf cable to the center N-type connector on the antenna relay module.

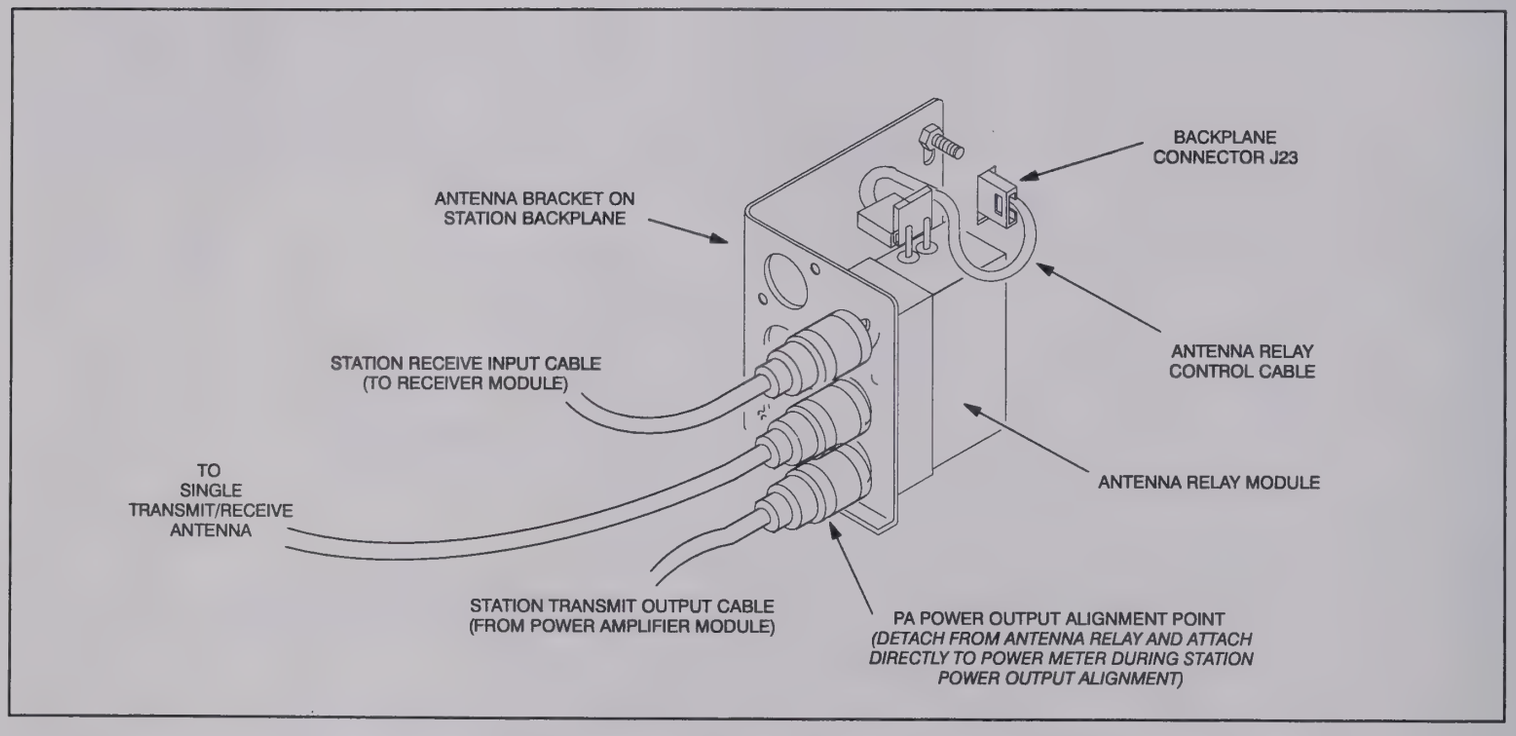


Figure 8–2. *Backplane Connections for Stations Equipped with Antenna Relay Module*

GPS Antenna/Receiver (Option X576)

If the station includes the Option X576 Reference Module with GPS Receiver, the GPS antenna is shipped with the station as part of Option X576, but you must provide the interconnecting cable between the GPS antenna and the station. Attach the interconnecting cable to the N-type connector in the center position of the inner row on the antenna bracket on the station Backplane (refer to Figure 8–3).

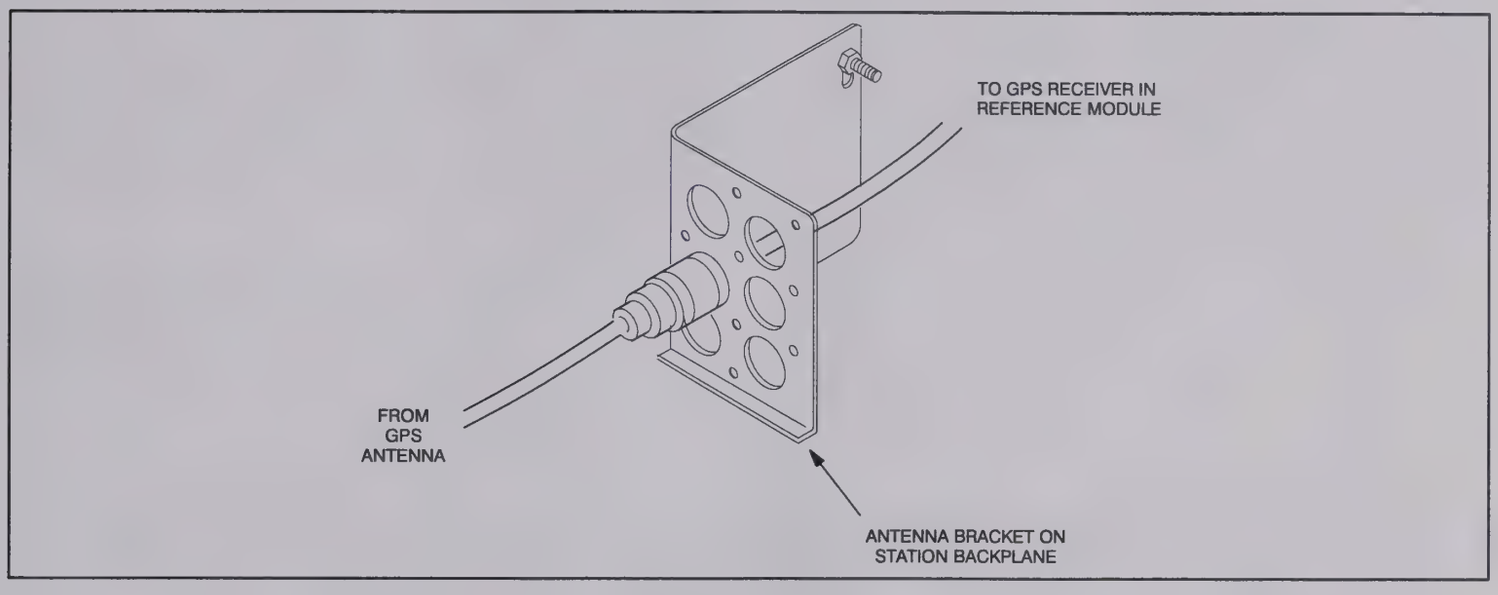


Figure 8–3. *Backplane Connection for GPS Antenna*

When installing the GPS antenna and interconnecting cable, the following must be considered:

- **Sky visibility** – Visibility from directly overhead down to within 10 degrees of the horizon is required for optimum performance. Obstructions such as adjacent buildings or towers cannot block more than 20% of the circumference of the sky visibility ring from 10 to 30 degrees above the horizon. Site engineering or system installation is optionally available from Global System Support Services.
- **Mounting** – The disc-shaped GPS antenna should be kept horizontal (refer to Figure 8–4). The post-mount L-shaped mounting bracket accepts a maximum diameter 30-mm post or bar. The clamp may be rotated to accept either a vertical or horizontal post or bar. Do not mount the GPS antenna on a tower (lightning strikes to the tower will damage the GPS antenna or GPS receiver). A lightning arrestor which passes dc voltage at the building entrance is recommended for safety but will not prevent damage. On a rooftop, mount at a height or location that minimizes snow coverage. Avoid multipath from large reflective surfaces other than those in the plane of the antenna base. Maintain at least ten feet separation from transmitter antennas (to provide at least 38 dB path loss from a 1 W isotropic radiator).
- **RF connectors** – The connector on the GPS antenna is type N male (requires type N female mating connector). The connector at the *Nucleus* station is type N female (requires type N male mating connector). The connector center contacts are gold-plated. Weatherproof the connector at the GPS antenna; Motorola part number TDN9289A or equivalent is recommended.

GPS Antenna/Receiver (Option X576) (continued)

- **Interconnecting cable** – A 50-ohm low-loss outdoor coaxial cable with solid copper outer conductor is recommended to minimize interference. The cable loss at 1.57542 GHz must be no more than 6 dB. An in-line amplifier may be used if it passes 5 V and uses no more than 25 mA at 5 V. Do not provide more than 8 dB of gain (including cable losses). The cabling system noise figure must be less than 15 dB. Site engineering or system installation is optionally available from Global System Support Services.
- **Use of more than one receiver per antenna** – The GPS receiver provides 5 V to the active GPS antenna. The output is ***not*** reverse polarity protected, so multiple receivers cannot be connected directly together off one antenna. Only one GPS receiver may power the GPS antenna; all other ports to other receivers must be dc-blocked to prevent damage.
- **Cabling system ohmic loss** – The maximum allowed voltage drop in the cable due to ohmic loss is 0.25 V at 22 mA for the antenna plus any added in-line amplifier current drain. The maximum voltage drop includes ohmic losses of the in-line amplifier(s) and bias tees; ohmic loss with the antenna only is 11 ohms maximum. Test delivered voltage by placing 200 ohms at the antenna connection point. Minimum voltage delivered should be 4.5 V. The required supply input voltage to the GPS antenna is 5.5 to 4.5 V.

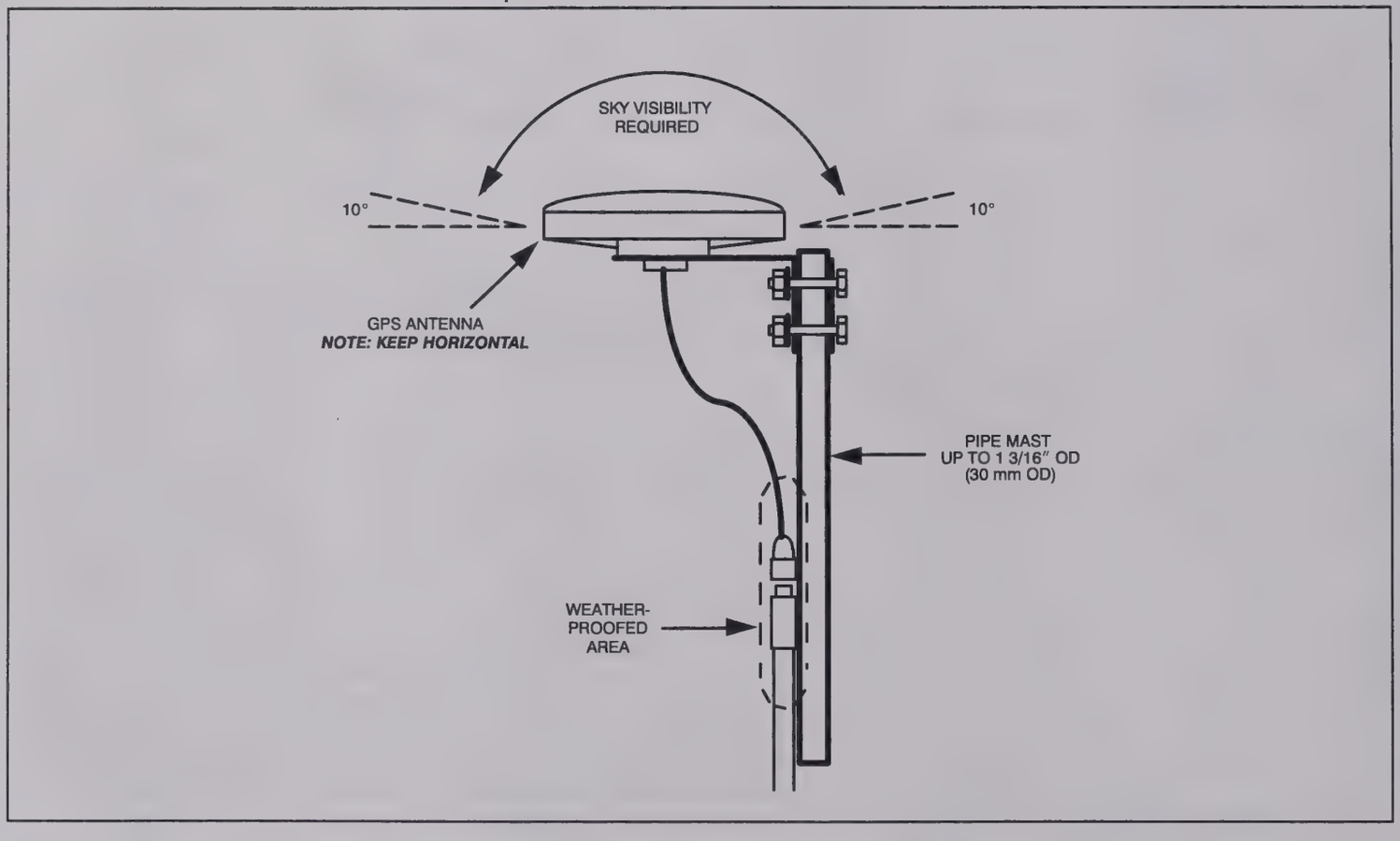


Figure 8–4. *GPS Antenna Mounting Details*

Triple Circulator (Option X676)

(Adds Double Circulator and External Wattmeter)

Option X676 adds a factory-installed double circulator assembly to a *Nucleus* Paging Station. The double circulator assembly combines with the single circulator located in the Power Amplifier Module to create the triple circulator.

The double circulator assembly consists of a double circulator, a 50 Ω load with heat sink, a low pass filter, and an external wattmeter secured to a peripheral bracket mounted on the rear of the station. The rf output from the Power Amplifier Module connects to the input of the double circulator, while the output of the double circulator connects to the external low pass filter. The output of the low pass filter connects to the external wattmeter. The external wattmeter output connects to the transmit antenna system. Refer to Figure 8–5.

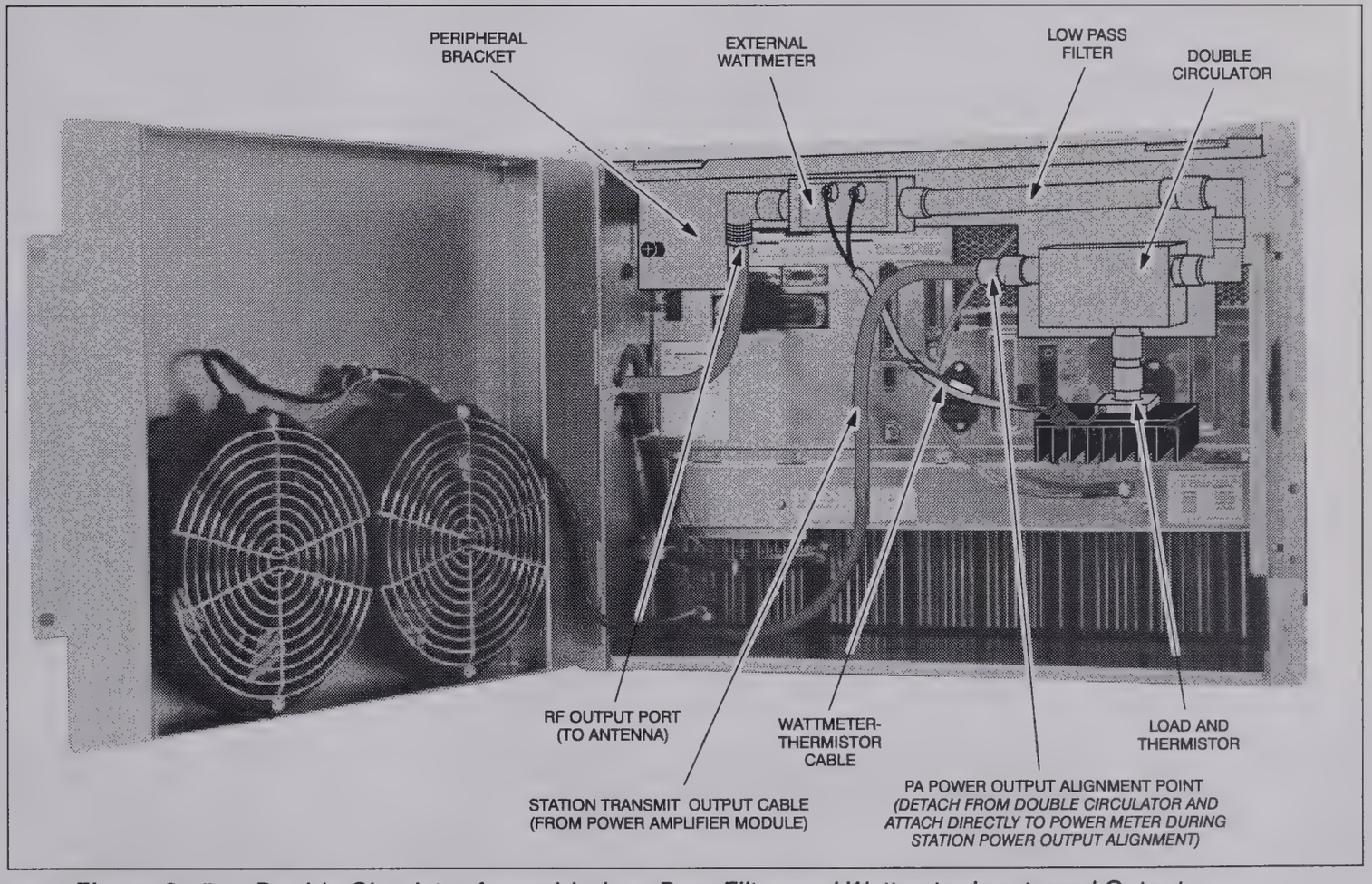


Figure 8–5. *Double Circulator Assembly, Low Pass Filter, and Wattmeter Inputs and Outputs (High Power Station shown)*

Double Circulator (Option X677)

(Adds Single Circulator and External Wattmeter)

Option X677 adds a factory-installed single circulator assembly to a *Nucleus* Paging Station. The single circulator assembly combines with the single circulator located in the Power Amplifier Module to create the double circulator.

The single circulator assembly consists of a single circulator, a 50 Ω load with heat sink, a low pass filter, and an external wattmeter secured to a peripheral bracket mounted on the rear of the station. The rf output from the Power Amplifier Module connects to the input of the single circulator, while the output of the single circulator connects to the external low pass filter. The output of the low pass filter connects to the external wattmeter. The external wattmeter output connects to the transmit antenna system. Refer to Figure 8–6.

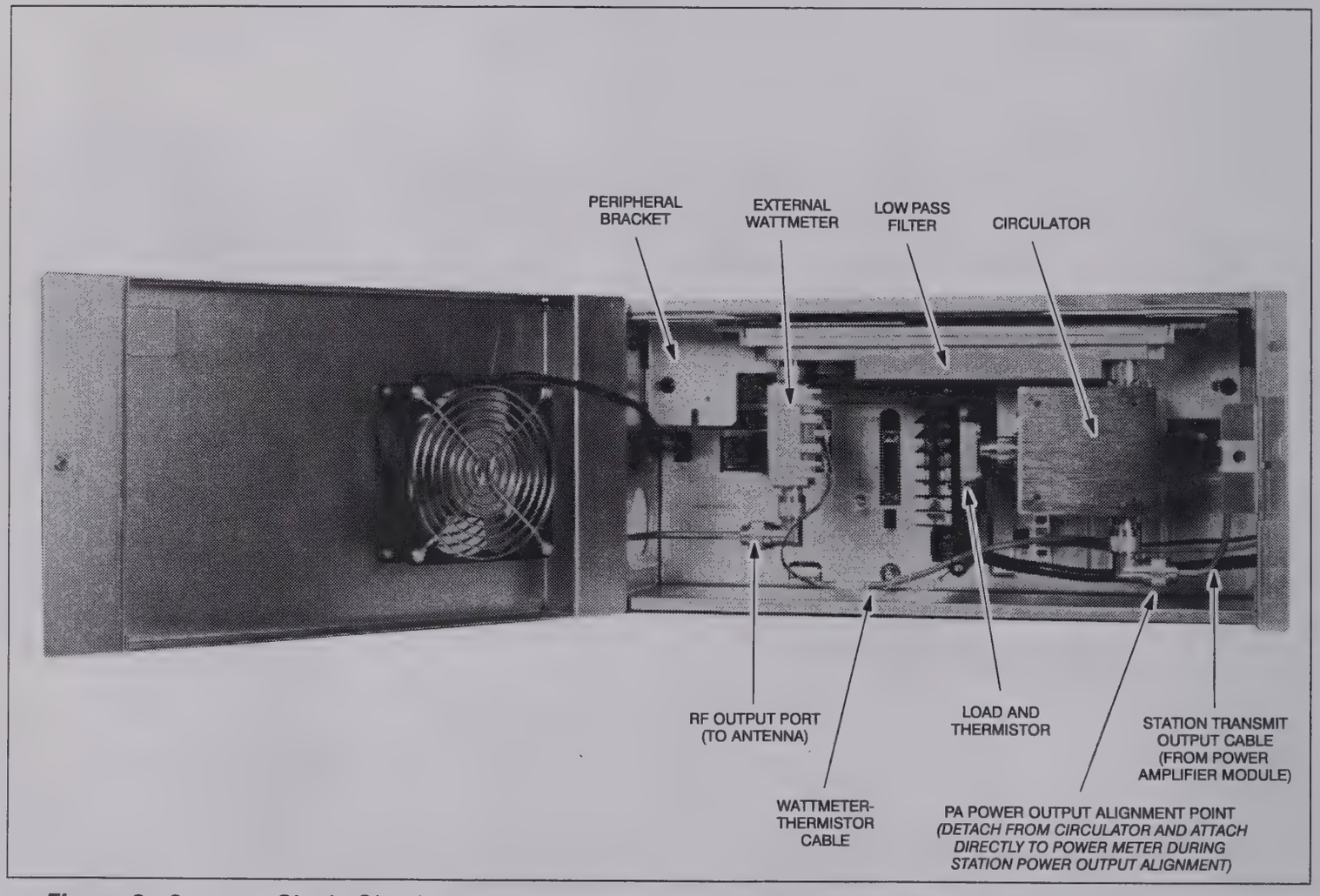


Figure 8–6. *Single Circulator Assembly, Low Pass Filter, and Wattmeter Inputs and Outputs (Standard Power Station shown)*

9 DIAGNOSTIC CONNECTIONS

This section provides procedures for making diagnostic connections to the *Nucleus* Paging Station Internal NIU via the station Backplane. ***If your station does not have an Internal NIU, skip this section.***

PSTN Interface
(requires Dial Modem Option X437)

The Option X437 Dial Modem is required for Public Switched Telephone Network (PSTN) connections.

If your station was ordered with Option X437, the Dial Modem is factory-installed on the Internal NIU board. For field-installation of the Dial Modem, see Section 19 – *Module Replacement Procedures*. To order the Dial Modem for field installation, order kit number TRN7993.

To connect the PSTN lines to the Internal NIU, use the following procedure:

Step 1. Connect telephone line **tip** to station Backplane connector J17, pair 5, ring conductor (pin 5) (Dial Modem +).

Step 2. Connect telephone line **ring** to station Backplane connector J17, pair 5, tip conductor (pin 30) (Dial Modem –).

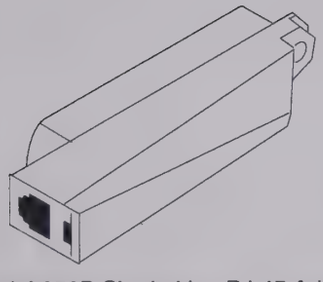
The PSTN connections to the Dial Modem may be made using the Model 259B Single-Line Adapter or the Model 258B Six-Line Adapter. These adapters mate with the Backplane 50-pin Telco connector (J17) and provide either one or six RJ-45 modular jacks for telephone line connection.

259B Single-Line RJ-45 Adapter. The 259B Adapter has a 50-pin male mini-ribbon connector, and distributes the line pairs from a 25-pair connectorized cable to a single RJ-45 modular jack. The physical dimensions of the adapter are 0.69″ (18 mm) W x 3.625″ (90 mm) H x 1.3″ (33 mm) deep. This adapter is available as Motorola Part No. 2882174W02.

The wiring information for this adapter is as follows:

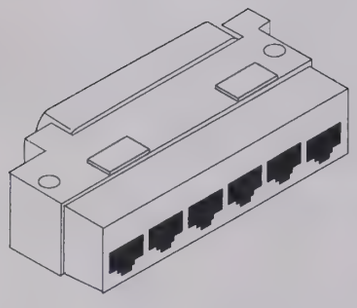
MODULAR JACK SPRING POSITION		BACKPLANE CONNECTOR J17 PINS	
PAIR 1	5	30	} PSTN connections
	4	5	
PAIR 2	3	32	
	6	7	
PAIR 3	2	6	
	7	33	
PAIR 4	1	31	
	8	8	

Modular jack spring positions are numbered sequentially from left to right with the tab facing upward.



Model 259B Single Line RJ-45 Adapter

PSTN Interface (continued)



Model 258B Six-Line RJ-45 Adapter

258B Six-Line RJ-45 Adapter. The 258B Adapter has a 50-pin male mini-ribbon connector, and distributes the pairs from a 25-pair connectorized cable to six RJ-45 modular jacks. The physical dimensions of the adapter are 0.9″ (23 mm) W x 3.6″ (90 mm) H x 1.7″ (43 mm) deep. This adapter is available as Motorola Part No. 2882174W01.

This adapter may be used in a single line application. It is required for installations having more than one telephone line connection (such as installations having both a dial modem and a monitor receiver). The wiring information for this adapter is as follows:

MODULAR JACK SPRING POSITION		BACKPLANE CONNECTOR J17 PINS					
		JACK 1	JACK 2	JACK 3	JACK 4	JACK 5	JACK 6
PAIR 1	5	26	30	34	38	42	46
	4	1	5	9	13	17	21
PAIR 2	3	28	32	36	40	44	48
	6	3	7	11	15	19	23
PAIR 3	2	2	6	10	14	18	22
	7	29	33	37	41	45	49
PAIR 4	1	27	31	35	39	43	47
	8	4	8	12	16	20	24

PSTN connections
(Modular Jack 2, Pair 1)

Modular jack spring positions are numbered sequentially from left to right with the tab facing upward.

External Monitor Receiver

If an external monitor receiver is used, connect the receiver using the following procedure. ***(If your station was ordered with an External Monitor Receiver option, a cable is provided which completes the necessary connections between the receiver and Backplane connector J17.)***

Step 1. Connect monitor receiver **audio** line to station Backplane connector J17, pair 22, tip conductor (pin 47) (Monitor Rx Audio).

Step 2. Connect monitor receiver **ground** line to station Backplane connector J17, pair 9, tip conductor (pin 34) (Ground).

External Alarms

If external alarms are to be sensed by the Internal NIU, connect the external alarm lines as follows:

Step 1. Connect **alarm #1 +** to station Backplane connector J17, pair 11, ring conductor (pin 11) (WC In 1).

Step 2. Connect **alarm #1 –** to station Backplane connector J17, pair 12, ring conductor (pin 12) (WC In 2), or to pair 7, ring conductor (pin 7) (Station Ground) if single-ended.

Step 3. Connect **alarm #2 +** to station Backplane connector J17, pair 23, ring conductor (pin 23) (WC In 3).

Step 4. Connect **alarm #2 –** to station Backplane connector J17, pair 22, ring conductor (pin 22) (WC In 4), or to pair 7, ring conductor (pin 7) (Station Ground) if single-ended.

Auxiliary Outputs

NOTE: *When Internal NIU DIP switch S16, poles 6 and 7 are set to ON, 5 volt pullups are provided on the Auxiliary Output #1 and #2 lines.*

If the Internal NIU is to drive auxiliary outputs, connect the auxiliary output lines as follows:

Step 1. Connect **auxiliary output #1** to station Backplane connector J17, pair 11, tip conductor (pin 36) (WC Out 1).

Step 2. If applicable, connect **auxiliary output #2** to station Backplane connector J17, pair 12, tip conductor (pin 37) (WC Out 2).

Auxiliary Relay Interface

If the Internal NIU is to supply an auxiliary relay interface, connect the relay interface lines as follows:

Step 1. Connect **relay control** line to station Backplane connector J17, pair 13, tip conductor (pin 38) (WC Out 3).

Step 2. Connect **relay #1 common** line to station Backplane connector J17, pair 24, tip conductor (pin 49) (Relay Common).

Step 3. Connect **relay #1 N.C.** line to station Backplane connector J17, pair 2, ring conductor (pin 2) (Relay N.C.).

Step 4. Connect **relay #1 N.O.** line to station Backplane connector J17, pair 2, tip conductor (pin 27) (Relay N.O.).

Step 5. Connect **relay #2 common** line to station Backplane connector J17, pair 15, tip conductor (pin 40) (WC Out 5).

Step 6. Connect **relay #2 N.C.** line to station Backplane connector J17, pair 18, tip conductor (pin 43) (WC Out 7).

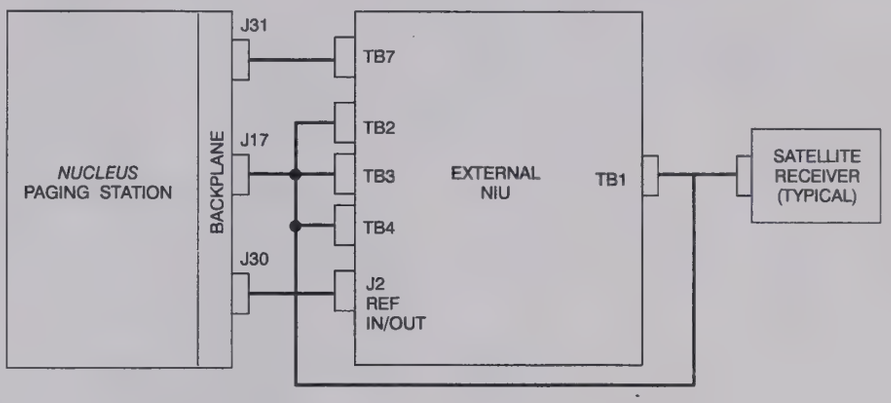
Step 7. Connect **relay #2 N.O.** line to station Backplane connector J17, pair 16, tip conductor (pin 41) (WC Out 6).

10 EXTERNAL LOCAL CONTROL CONNECTIONS

This section is only for stations that do not have an Internal NIU, and have an external NIU or other external local control device.

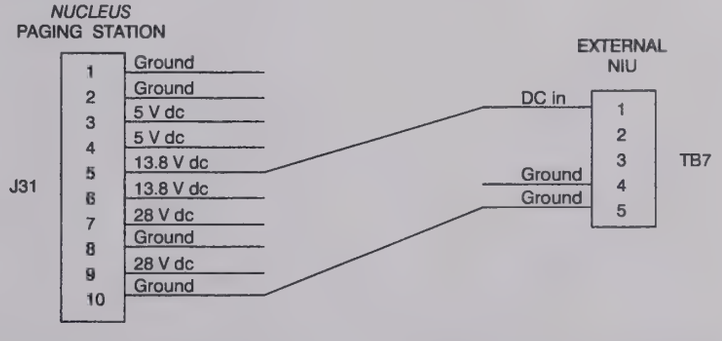
External NIU Connections

An external NIU connects to the *Nucleus* Paging Station via Backplane Connectors J17, J30, and J31. The basic cabling is as shown below.



Connector J31

The following diagram shows the dc power signals on station Backplane connector J31 and the corresponding connections on external NIU connector TB7. ***On connector J31, be sure to use one of the 13.8 V pins for dc output (pin 5 or pin 6), not the 5 V or 28 V pins.***



If connector J31 is occupied with a connector supplying power to the fans in the station rear door, you must use another dc power source for the external NIU.

Connector J30

Use a BNC-to-BNC coaxial cable between station Backplane connector J30 and external NIU connector J2.

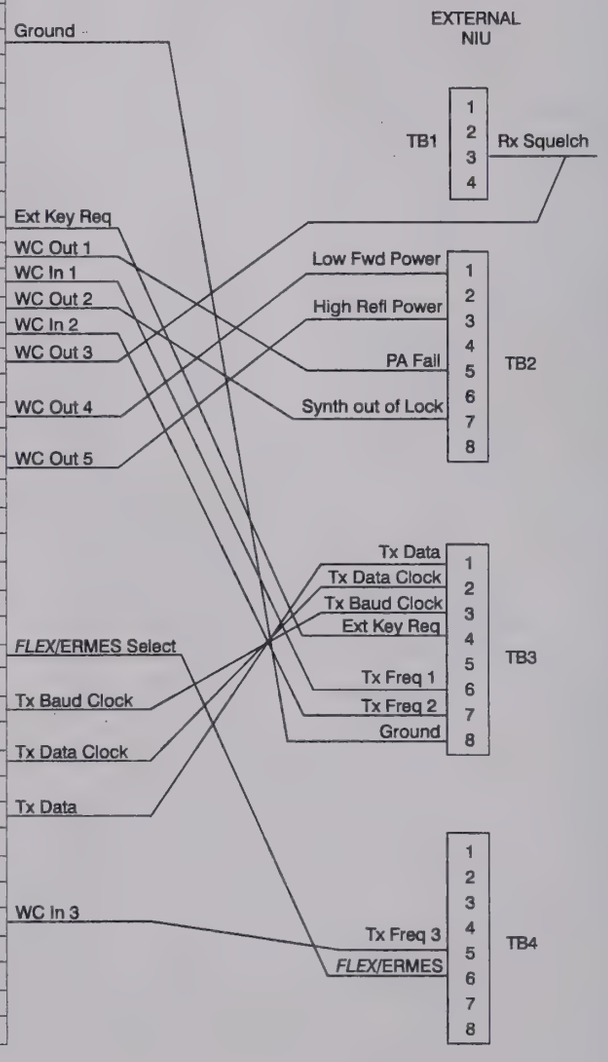
External NIU Connections (continued)

Connector J17

The following diagram shows the required signals on station Backplane connector J17 and the corresponding connections on external NIU connectors TB1, TB2, TB3, and TB4.

NUCLEUS PAGING STATION
J17

Punch Block Pair #		Pin #	Wire Color Main / Trace
1	Tip	26	White / Blue
	Ring	1	Blue / White
2	Tip	27	White / Orange
	Ring	2	Orange / White
3	Tip	28	White / Green
	Ring	3	Green/ White
4	Tip	29	White / Brown
	Ring	4	Brown / White
5	Tip	30	White / Slate
	Ring	5	Slate / White
6	Tip	31	Red / Blue
	Ring	6	Blue / Red
7	Tip	32	Red / Orange
	Ring	7	Orange / Red
8	Tip	33	Red / Green
	Ring	8	Green / Red
9	Tip	34	Red / Brown
	Ring	9	Brown / Red
10	Tip	35	Red / Slate
	Ring	10	Slate / Red
11	Tip	36	Black / Blue
	Ring	11	Blue / Black
12	Tip	37	Black / Orange
	Ring	12	Orange / Black
13	Tip	38	Black / Green
	Ring	13	Green / Black
14	Tip	39	Black / Brown
	Ring	14	Brown / Black
15	Tip	40	Black Slate
	Ring	15	Slack / Black
16	Tip	41	Yellow / Blue
	Ring	16	Blue / Yellow
17	Tip	42	Yellow / Orange
	Ring	17	Orange / Yellow
18	Tip	43	Yellow / Green
	Ring	18	Green / Yellow
19	Tip	44	Yellow / Brown
	Ring	19	Brown / Yellow
20	Tip	45	Yellow / Slate
	Ring	20	Slate / Yellow
21	Tip	46	Violet / Blue
	Ring	21	Blue / Violet
22	Tip	47	Violet / Orange
	Ring	22	Orange / Violet
23	Tip	48	Violet / Green
	Ring	23	Green / Violet
24	Tip	49	Violet / Brown
	Ring	24	Brown / Violet
25	Tip	50	Violet / Slate
	Ring	25	Slate / Violet



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Synchronous Local Control (SYLC) Interface

If the Nucleus Paging Station does not have an NIU, it requires an external local control device that communicates with it using the Synchronous Local Control (SYLC) interface.

The SYLC interface transfers paging data to the transmitter modulator. Paging data is synchronously transferred from the external local control device to the *Nucleus* Paging Station using three TTL-compatible lines: *Baud Clock, Data Clock,* and *Data.* The baud clock runs at the symbol rate and is used to indicate symbol boundaries. The data clock runs at the bit rate and is used to clock in data bits from the data line. (In the two-level case, the baud clock and the data clock run at equal rates.) During idle conditions, the baud and data clocks go to a high state.

Key control is provided via the *Ext Key Req* line. The key signal must go active 250 milliseconds prior to valid data. The *Ext Key Req* line must be programmable as either active high or active low.

Station Interconnects

All interconnects for the SYLC interface are accessible on station Backplane connector J17. The table below shows the required signals.

For two-level data, the FLEX/*ERMES Select* line must be pulled high. To do this, connect pin 18 through a pull-up to pin 8.

J17 Pin No.	Description
10	Ext Key Req
18	*FLEX*/ERMES Select
19	Tx Baud Clock
20	Tx Data Clock
21	Tx Data
8	+5 V dc

Wildcard Interface Board

The Wildcard Interface Board is an input/output board used to provide logic input and output signals for external equipment interface. The input and output hardware logic signals are referred to as Wildcards since they can be defined in software to have various signal meanings. Wildcard outputs are typically used to indicate a station operating status such as alarm information for external site equipment.

The Wildcard inputs can be used for accepting local control signals from peripheral equipment or be used to monitor the status of on-site equipment and report the status back to the controller if diagnostics are supported in the system. The board also contains an alarm relay with normally open or normally closed connections. All access to the Wildcard interface is provided via station Backplane connector J17.

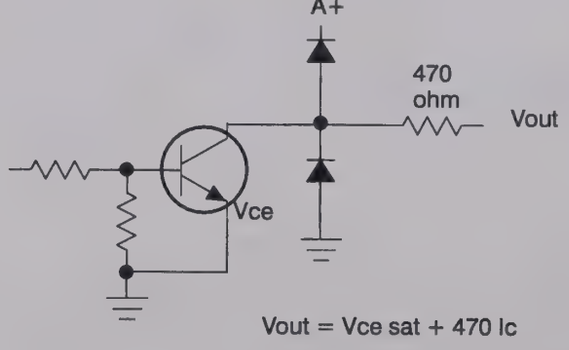
Wildcard Outputs

There are eight Wildcard output signals. The following table describes the Wildcard outputs and gives the pin-outs on Backplane connector J17.

Wildcard Output	Description	Connector J17 Pin Number
1	PA Fail Alarm	36
2	Synthesizer Out of Lock	37
3	Internal Rx Squelch	38
4	Low Forward Power	39
5	High Reflected Power	40
6	Battery Revert Alarm	41
7	PA Fan Fail Alarm	43
8	System Timer	44

The Wildcard outputs are open-collector transistors with 470-ohm series resistors. Special attention should be given to the series 470-ohm resistors when interfacing the Wildcard outputs to external equipment. The series 470-ohm resistor will increase the Wildcard output voltage level as more current is sunk by the transistor. The Wildcard outputs can only drive LS TTL, ALS TTL, Fast TTL and CMOS logic. The Wildcard output cannot drive a standard TTL load reliably since the guaranteed low voltage spec will be marginal at 0.8 V. The 470 ohms will act as a divider when used with an external pull-up resistor, therefore the external pull-up should be at least 10K or greater to minimize the output voltage increase. Ic should be ≤ 1.2 mA to ensure that Vout is ≤ 0.8 V for logic integrity.

The following is a schematic representation of the Wildcard output circuits.



Vout = Vce sat + 470 Ic

Wildcard Interface Board (continued)

Wildcard Inputs

There are eight wildcard inputs which can be selected in software as either active high or active low signals. The wildcard input interface effectively looks like a 28K pull-up resistor to +5 V. Normally the wildcard inputs are at 1.5 V in the idle state due to an internal resistor divider network. The wildcard inputs are software debounced using 4 read cycles, once every 10 milliseconds. The inputs must be stable for at least 40 milliseconds for the software to have a valid indication of an input being selected.

The following table lists the pin-outs of the wildcard inputs on Backplane system connector J17:

Wildcard Input	Connector J17 Pin Number	Wildcard Input	Connector J17 Pin Number
1	11	5	45
2	12	6	16
3	23	7	25
4	22	8	42

Wildcard Alarm Relay

The alarm relay provides external closure contacts for user-selected station alarms.

The relay has the following operating specifications:

Maximum Switching Power:	30 W/62.5 VA
Maximum Switching Current:	1 A
Maximum Switching Voltage:	220 V dc, 250 V ac
Operate Time:	2 ms
Release Time:	1 ms

The following table lists alarm relay connections to Backplane connector J17:

Alarm Relay Connection	Connector J17 Pin Number
Normally Open	27
Common	49
Normally Closed	2

11 USING THE CONTROL FRONT PANEL

The *Nucleus* Control front panel keypad and display let you view or change configuration and alignment parameters. The Control front panel LEDs indicate status conditions for the Station Control Module (SCM) and Internal NIU (if installed).

Keypad

The 15-pushbutton keypad (shown at left) allows you to view and change menu parameters. (See the Quick Reference Menu Guide at the end of this section.) The top 12 keys each have two markings: a menu name used to select a menu (Menu Select Mode), and a numeral or ▲ or ▼ symbol used to edit parameters within a menu (Edit Mode).

- **Menu Select Mode:** When the Control front panel display reads **READY**, the SCM is in Menu Select Mode. Press any key to select the menu printed on that key.
- **Edit Mode:** When the Control front panel display is flashing, the SCM is in Edit Mode. Press the numeral keys to enter a new numeric value, or press the ▲/▼ keys or **TOG** key to display other available menu choices. Once the desired value or menu choice is displayed, press the **ENT** key to store it. Press the **EXIT** key to go back to the previous menu level. (If the **ENT** key is not pressed before the **EXIT** key is pressed, the previous value or menu choice remains stored for that entry.)

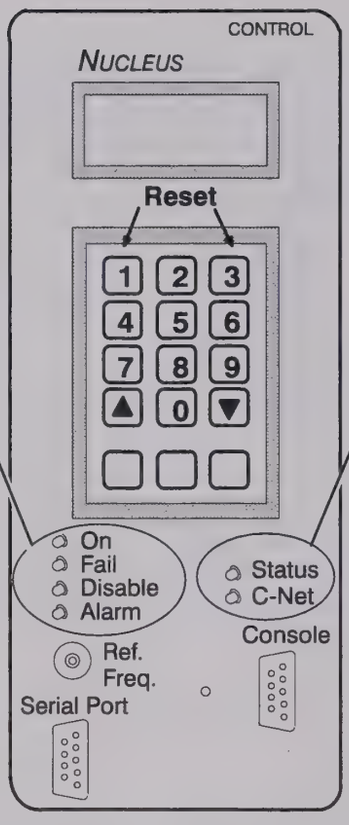
1 STN — **Edit Mode:** Press to enter value of 1. **Menu Select Mode:** Use **STN** to set up and view station parameters.	2 RX — **Edit Mode:** Press to enter value of 2. **Menu Select Mode:** Use **RX** to set up and view receiver parameters.	3 TX — **Edit Mode:** Press to enter value of 3. **Menu Select Mode:** Use **TX** to set up and view transmit parameters.
4 OPT1 — **Edit Mode:** Press to enter value of 4. **Menu Select Mode:** Use **OPT 1** to set up and view station option parameters.	5 OPT2 — **Edit Mode:** Press to enter value of 5. **Menu Select Mode: OPT 2** is currently not supported.	6 ASET — **Edit Mode:** Press to enter value of 6. **Menu Select Mode:** Use **ASET** to set up alarms.
7 STAT — **Edit Mode:** Press to enter value of 7. **Menu Select Mode:** Use **STAT** to display station status.	8 CNFG — **Edit Mode:** Press to enter value of 8. **Menu Select Mode:** Use **CONFG** to set up and view configuration parameters.	9 ALMS — **Edit Mode:** Press to enter value of 9. **Menu Select Mode:** Use **ALMS** to view and/or clear alarms.
▲ SERV — **Edit Mode:** Press ▲ to move up to the next menu selection. **Menu Select Mode:** Use **SERV** to enter the service mode.	0 DIS — **Edit Mode:** Press to enter value of 0. **Menu Select Mode:** Use **DIS** to disable remote keyup while allowing local keyup; also to view disable status.	▼ ALGN — **Edit Mode:** Press ▼ to move down to the next menu selection. **Menu Select Mode:** Use **ALGN** to perform station alignment or key and read power.
EXIT — Use **EXIT** to return to the Menu Select mode, move outward one menu level, or abort an edit session.	TOG — Use **TOG** to change editted values or selections.	ENT — Use **ENT** to store keyed-in values, move inward one menu level, or begin an edit session.
Reset — Press the **1/STN** and **3/TX** keys simultaneously to cause the station to reinitialize, perform power-up diagnostics and reset all RAM values.		

LEDs

There are four Station Control Board LEDs on the left side of the Control front panel, and two Internal NIU LEDs on the right side (if an Internal NIU is installed). Figure 11–1 shows LED locations and the status descriptions for each LED.

Station Control Board LEDs

On	**GREEN** when SCM fully functional
	OFF for SCM failure
Fail	**RED** for SCM failure
	FLASHES when a software checksum failure is detected
	OFF when SCM fully functional (no failure)
Disable	**RED** when station is disabled from remote keying (when maintenance access or paging access is disabled)
	FLASHES when DRAM address lines are open
	OFF when SCM is enabled and fully functional
Alarm	**RED** for active station alarm (go to Alarms Menu to check)
	FLASHING when DRAM address lines are shorted
	OFF when SCM is fully functional and no alarms



Internal NIU LEDs

Status	**FLASHES GREEN SLOWLY** when Internal NIU status is normal, no alarms
	FLASHES GREEN FAST when Internal NIU dial modem has DCD connected
	FLASHES ORANGE SLOWLY when Internal NIU alarm exists or has occurred
	FLASHES ORANGE FAST when Internal NIU alarm exists or has occurred and dial modem is connected
	RED for Internal NIU malfunction
C-NET	**GREEN** when C-NET has sync
	FLASHES GREEN SLOWLY when C-NET has sync and running ROM memory
	ORANGE when C-NET lost sync for less than 30 seconds
	FLASHES ORANGE SLOWLY when C-NET lost sync for less than 30 seconds and running ROM memory
	RED when C-NET lost sync for more than 60 seconds
	FLASHES RED when C-NET lost sync for more than 60 seconds and running ROM memory
	OFF when squelch active, no C-NET sync

NOTES:

1. All LEDs momentarily light following station reset or upon station power-up.
2. If no LED indicators are on, make sure that power to the station power supply is present. Check the circuit breaker at the power source. Check the power line cord. If no problem is found, suspect the Power Supply Module.
3. Internal NIU LEDs are only present if an Internal NIU is installed in the station.

Figure 11–1. *Control Panel LED Indicators and Status Descriptions*

Procedures

Accessing the Control Front Panel

Step 1. From a blank display, press any key on the Control front panel keypad.

Step 2. If the password feature is disabled, the display reads **READY** after the key is pressed. If you want to enable the password feature, see the procedure below.

If the password feature is enabled, the display reads **READY – ENTER PASSWORD** after the key is pressed.

Step 3. To enter the password, press the number keys and then press the **ENT** key. (The default password is 6000.) When you have entered the correct password, the display reads **READY**.

If a key has not been pressed for five minutes, the display will go blank. Follow the procedure above to regain access to the Control front panel.

Changing the Password

CAUTION

If you change the password, be sure to display the value to confirm it before the display times out and goes blank.

If you forget your password, you will need to reset all station configuration parameters to their default settings.

Step 1. From the **READY** prompt, press the **STN** key to enter the Station menu. The display shows **TX FREQ RANGE**. Press the up or down key (▲ or ▼) until **PASSWORD xxxx** is displayed, where xxxx is the current password value.

Step 2. Press the **ENT** key. The display shows **xxxx** (flashing), where xxxx is the current password value.

Step 3. Press the number keys to enter the new password. Any value from 0 to 9999 can be entered. *(*Refer to **CAUTION** at left.*)* Then press the **ENT** key. The display shows **PASSWORD yyyy**, where yyyy is the newly entered password value.

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Disabling or Enabling the Password Feature

Step 1. From the **READY** prompt, press the **STN** key to enter the Station menu. The display shows **TX FREQ RANGE**. Press the up or down key (▲ or ▼) until **FRONT PANEL PASSWORD: ENABLED** (or **DISABLED**) is displayed.

Step 2. Press the **ENT** key. The display shows **ENABLED** (or **DISABLED**) (flashing).

Step 3. Press the **TOG** key. The display shows **DISABLED** (or **ENABLED**) (flashing).

Step 4. Press the **ENT** key. The display shows **FRONT PANEL PASSWORD: DISABLED** (or **ENABLED**). The password is now disabled (or enabled).

Step 5. Press the **EXIT** key to return to the **READY** prompt.

Procedures (continued)

NOTE *– Refer to the Quick Reference Menu Guide (on the next page) for a list of parameter menus.*

NOTE *– Once a menu has been selected, the menu title will appear on the display. If the title is nine characters or more, it will be scrolled across the display.*

REMINDER *– Only entry values that are at the most inward menu level can be changed. To exit back one level, press the* ***EXIT*** *key.*

Changing Parameters with the Keypad

When the Control front panel display reads **READY**, you can use the parameter menus as follows:

Step 1. Select a menu by pressing the appropriate key (for example, **TX** for the Transmit menu).

Step 2. The menu title will appear briefly on the display; then the first entry of the menu will appear. Press the up/down keys (▲/▼) to scroll through the menu entries.

Step 3. When the desired menu entry appears on the display, press the **ENT** key to select it.

If the entry you select is at the most inward menu level, its value will begin flashing on the display; go to Step 6 below. (Flashing indicates Edit Mode.)

If the entry you select is a sub-menu title, go on to Step 4.

Step 4. The first entry of the sub-menu will appear. Again, press the up/down (▲/▼) keys to find an entry in the sub-menu.

Step 5. When the desired sub-menu entry appears on the display, press the **ENT** key to select it. Its value will begin flashing on the display.

Step 6. Press the up/down (▲/▼) keys or **TOG** (toggle) key to display other available menu choices, or enter a numeric value using the numeral keys. Once the desired value or menu choice is displayed, press the **ENT** key to store it. Press the **EXIT** key to go back to the previous menu level. (If the **ENT** key is not pressed before the **EXIT** key is pressed, the previous value or menu choice remains stored for that entry.)

NUCLEUS™ PAGING STATION QUICK REFERENCE MENU GUIDE

STN – STATION

- TX FREQ RANGE (read only)
- CURRENT TX CHN *
  - 1
  - •
  - •
  - •
  - 32
  - ALIGN 1 VCO
  - •
  - •
  - •
  - ALIGN 4 DELAY

  (SEE NOTE)
- SYS TIMER ALRM *
  - DISABLE
  - 2 MIN
  - 15 MIN
  - 30 MIN
  - 60 MIN
  - 90 MIN
  - 120 MIN
  - 180 MIN
- FRONT PANEL PASSWORD *
  - ENABLED
  - DISABLED
- PASSWORD (FACTORY DEFAULT = 6000)
- SET STATION TIME
  - YEAR
  - MONTH
  - DAY
  - HOUR
  - MINUTE
  - SECONDS

RX – RECEIVER

- RX FREQ RANGE (read only)
- RX CHN FREQ
- CHN SPACING *
  - 12.5 KHZ
  - 20 KHZ
  - 25 KHZ
- RX DEEMPHASIS *
  - ENABLED
  - DISABLED
- RX OUTPUT *
  - INVERTED
  - NOT INVERTED
- MONITOR RX OUTPUT *
  - ANALOG
  - TTL

NOTE

Alignment channels are displayed in the **STN** menu but are automatically selected during alignment procedures from the **ALGN** menu. ***Do not*** attempt to select them from the **STN** menu.

TX – TRANSMIT

- TX CHN FREQS
  - CHN 1 FREQ
  - •
  - •
  - •
  - CHN 32 FREQ
  - MEAN FREQ
- TX CHN PWR *(if CHN MAPPED PWR disabled)*
  - OPERATING PWR
- TX CHN PWR *(if CHN MAPPED PWR enabled)*
  - CHN 1 PWR
  - •
  - •
  - •
  - CHN n PWR**
  - MEAN FREQ PWR
- TX CHN OFFSETS
  - HIGH SPEED OFFSET
  - LOW SPEED OFFSET
- LOW SPEED SPLATTER FILTER *
  - 88 US LOW PASS
  - 140 US LOW PASS
  - 250 US LOW PASS
- NOMINAL BINARY DEVIATION
- SPECIAL TX SETUP
  - TX DATA INVERT *
    - ENABLED
    - DISABLED
  - TX = RX *
    - ENABLED
    - DISABLED
- IDLE DEVIATION *
  - NULL
  - SPACE
  - MARK

OPT 1 – STATION OPTIONS 1

- ANTENNA RELAY *
  - DISABLED
  - ENABLED
- EXT CIRCULATOR *
  - NOT PRESENT
  - PRESENT
- CHN MAPPED PWR *
  - DISABLED
  - ENABLED

ASET – ALARM SETUP

- FWD PWR ALM PT
- RFL PWR ALM PT
- EXT WM FWD PWR ALM PT
- EXT WM RFL PWR ALM PT

**Appears only if CHN n FREQ ≠ 0

STAT – STATION STATUS

- FWD PWR
- RFL PWR
- VSWR
- EXT WM FWD PWR
- EXT WM RFL PWR
- EXT WM VSWR
- SOFTWARE VERSIONS
  - APPLICATION
  - EXCITER
  - BOOT
  - ALIGNMENT ID
    - SCM
    - EXCITER

CNFG – STATION CONFIGURATION

- MAX PWR (read only)
  - NO PA
  - 20 W
  - 25 W
  - 100 W
  - 125 W
  - 300 W
  - 350 W
- BATTERY REVERT SETUP
  - BATTERY TYPE *
    - VENTED LEAD CALCIUM
    - SEALED LEAD CALCIUM
    - NICAD
    - GENERIC
    - BATTERY REVERT DISABLED
  - CHARGING *
    - ENABLED
    - DISABLED
  - BACKUP *
    - BACKUP STATION
    - BACKUP CONTROL
  - FIXED CUTBK RED %
- EXT WATTMETER TYPE *
  - NONE
  - CLASS 1 EXT
  - CLASS 2 EXT
  - CLASS 3 EXT
  - CLASS 4 EXT
- CONTROL *
  - INTERNAL CNET
  - EXT SYNCH LOCAL CTRL
- RX TYPE *
  - NO INTERNAL
  - INTERNAL LINK
  - INTERNAL MONITOR
- SPECIAL KEY SELECT *
  - NONE
  - CD INT
  - CD EXT
  - SPCL KEY
  - FAST LOW
  - FAST HIGH
  - EXT LOW
  - EXT HIGH

ALMS – STATION ALARMS

- LOW FORWARD POWER
- HIGH REFLECTED POWER
- EXT LOW FORWARD POWER
- EXT HIGH REFLECTED POWER
- REDUNDANCY SWITCHOVER
- PA FAN
- SYNTH OUT OF LOCK
- BATTERY REVERT
- SYS TIMER EXPIRED
- PA FAIL
- STATION RESET
- HIGH STABILITY REF FAIL
- ALIGNMENT ID MISMATCHED

SERV – SERVICE MODE

- PA TEST MODE *
  - ACTIVE
  - INACTIVE
- SELECT SYMBOL *
  - STAIRCASE
  - 01–10
  - 00–11
  - 10
  - 11
  - 01
  - 00
  - CARRIER
- KEY ON SYMBOL

DIS – ACCESS DISABLE

- MAINT ACCESS
  - DISABLED
  - ENABLED
- PAGING ACCESS
  - DISABLED
  - ENABLED
- DISABLE STATUS (read only)
  - DISABLE_1
  - •
  - •
  - •
  - DISABLE_n

ALGN – STATION ALIGNMENT

- CAL STATION POWER
  - INITIALIZE CALIBRATION
    - INPUT MEASURED PWR
  - CALIBRATE ***
    - INPUT MEASURED PWR
- CAL EXT WM
- ALIGN UHSO
  - KEY START
  - START
- KEY AND READ POWER
- KEY AND READ EXT WM POWER

RESET – RESET STATION

PRESS BUTTONS 1 & 3 SIMULTANEOUSLY

***For factory use only

* (select one of the following)

12 STATION CONFIGURATION

All station configuration parameters are programmable from the station Control front panel, as described in Section 11 – *Using the Control Front Panel*. Follow the configuration procedures in this section to configure the station and to verify or change station configuration.

Configuration Procedure

Control

The **CONTROL** parameter lets you select the station control mode. If the station is equipped with the Internal NIU (C-NET) option, select **INTERNAL CNET**. For all other installations (including an external NIU), select **EXT SYNCH LOCAL CONTROL**.

Step 1. From the **READY** prompt, press the **CNFG** key to enter the Station Configuration menu. Press the ▼ key until **CONTROL: EXT SYNCH LOCAL CONTROL** (or **: INTERNAL CNET**) is displayed.

Step 2. Press the **ENT** key. The display shows **EXT SYNCH LOCAL CONTROL** (or **INTERNAL CNET**) (flashing).

Step 3. Press the **TOG** key to change the setting, followed by **ENT**. The display shows **CONTROL: EXT SYNCH LOCAL CONTROL** (or **: INTERNAL CNET**).

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Special Key Select

The **SPECIAL KEY SELECT** parameter lets you configure the paging station for external keying. The external key request may be programmed *Active Low* by selecting **EXT LOW** or *Active High* by selecting **EXT HIGH**. Select **EXT LOW** if the station is equipped with the Internal NIU option or with external synchronous local control (such as an external NIU). Select **NONE** to disable external key requests.

Step 1. From the **READY** prompt, press the **CNFG** key to enter the Station Configuration menu. Press the ▼ key until **SPECIAL KEY SELECT: NONE** (or **: EXT LOW**, etc.) is displayed.

Step 2. Press the **ENT** key. The display shows **NONE** (or **EXT LOW**, etc.) (flashing).

Step 3. Use the **TOG** key or the ▼ key to scroll through the menu choices. Press the **ENT** key to select a new choice. The display shows **SPECIAL KEY SELECT: NONE** (or **: EXT LOW**, etc.).

Step 4. Press the **EXIT** key to return to the **READY** prompt.

IMPORTANT

Select **EXT LOW** for **SPECIAL KEY SELECT** if the station is equipped with the Internal NIU option or with external synchronous local control (such as an external NIU).

NOTE: *The* **SPECIAL KEY SELECT** *menu contains additional choices which are not supported at this time.*

Configuration Procedure (continued)

IMPORTANT

In order to set or change transmit frequencies from the front panel, set switch #1 of DIP switch S751 on the Station Control Board (SCB) to the ON position, then do a station reset. Refer to Section 19 – *Module Replacement Procedures* for removal and replacement procedures for the SCB. When all frequencies are entered, return the switch to the OFF position, then do a station reset.

NOTE: *The only valid* ***TX CHN FREQS*** *entries are transmitter synthesizer frequencies and 0 (used to deprogram the channel).*

Transmitter Frequency Range

Use the **TX FREQ RANGE** parameter (read-only) to verify the station transmitter frequency range. The frequency range is determined by the installed PA and Exciter Modules.

From the **READY** prompt, press the **STN** key to enter the Station menu. The display shows **TX FREQ RANGE: xxx–yyy MHZ**, where xxx–yyy is the frequency range (in MHz) of the station transmitter.

Transmitter Channel Frequencies

Transmit frequencies are normally set at the factory. The **TX CHN FREQS** parameter lets you change the frequency of each of the 32 available transmit channels of the station.

Step 1. From the **READY** prompt, press the **TX** key to enter the Transmit menu. The display shows **TX CHN FREQS**.

Step 2. Press the **ENT** key. The display shows **CHN 1 FREQ xxx.xxxx MHZ**, where xxx.xxxx is the currently programmed frequency for channel 1.

Step 3. Press the **ENT** key. The display shows **xxx.xxxx** (flashing) where xxx.xxxx is the current value for the field.

Step 4. Enter the new value for the field using the digit keys, followed by **ENT**. The frequency is displayed in MHz, with four places to the right of the decimal point. The decimal point is fixed, so as each new digit is entered, the previously entered digits move to the left. After you press **ENT**, the display shows **CHN 1 FREQ yyy.yyyy MHZ**, where yyy.yyyy is the newly entered value.

For example, to set the channel for 928.5000 MHz, enter the digits **9285000** and press **ENT**. The display shows **CHN 1 FREQ 928.5000 MHZ**.

Step 5. Press the ▼ key to move to the next channel, repeating Step 3 and Step 4 for each channel.

Step 6. To display the mean (average) frequency of all programmed channels, use the ▲ or ▼ key to move to the **MEAN FREQ zzz.zzzz MHz** field (after Channel 32). The station keys on mean frequency in the Station Power Output Alignment Procedure, External Wattmeter Calibration, and UHSO/HSO Alignment Procedure in Section 14 – *Station Alignment*.

Step 7. Press the **EXIT** key twice to return to the **READY** prompt.

Configuration Procedure (continued)

Operating Power (Channel-Mapped Power Disabled)

Using the channel-mapped power feature, you can configure the station to transmit at a different power level for each transmit channel. By default, the channel-mapped power feature is disabled. ***Use the procedure below if channel-mapped power is disabled and will not be enabled. Use the procedures on the following page to enable and configure channel-mapped power.***

When the channel-mapped power feature is disabled, the station transmits at the same power level regardless of which channel is the current transmit channel. Transmit power is set by default at the low end of the station's power amplifier range. To verify or change transmit power, use the **TX CHN PWR** parameter.

Step 1. From the **READY** prompt, press the **TX** key to enter the Transmit menu. Press the ▼ key until **TX CHN PWR** is displayed.

Step 2. Press the **ENT** key. The display shows **OPERATING PWR xxx W,** where xxx is the currently programmed station transmit power.

Step 3. To change the station power, press the **ENT** key. The station power value flashes.

Step 4. Enter the desired station power value in watts, using the front panel digit keys. Then press the **ENT** key. The display shows **OPERATING PWR yyy W,** where yyy is the newly entered station power value.

Step 5. Press the **EXIT** key twice to return to the **READY** prompt.

Configuration Procedure (continued)

Channel Power (Channel-Mapped Power Enabled)

Using the channel-mapped power feature, you can configure the station to transmit at a different power level for each transmit channel. Use the following procedure to enable the channel-mapped power feature.

Step 1. From the **READY** prompt, press the **OPT1** key to enter the Station Options 1 menu. Press the ▼ key until **CHN MAPPED PWR: DISABLED** is displayed.

Step 2. Press the **ENT** key. The display shows **DISABLED** (flashing).

Step 3. Press the **TOG** key to change the setting, followed by **ENT.** The display shows **CHN MAPPED PWR: ENABLED**.

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Transmit power for each channel is set by default at the low end of the station's power amplifier range. To verify or change transmit power for each channel, use the **TX CHN PWR** parameter.

Step 1. From the **READY** prompt, press the **TX** key to enter the Transmit menu. Press the ▼ key until **TX CHN PWR** is displayed.

Step 2. Press the **ENT** key. The display shows **CHN n PWR xxx W,** where xxx is the currently programmed transmit power for channel n.

Only channels that have a non-zero frequency entered under the **TX CHN FREQS** *sub-menu will have a channel power displayed.*

Step 3. To change the power for channel n, press the **ENT** key. The channel power value flashes.

Step 4. Enter the desired channel power value in watts, using the front panel digit keys. Then press the **ENT** key. The display shows **CHN n PWR yyy W,** where yyy is the newly entered power value for channel n.

Step 5. To verify transmit power for other channels, press the ▼ key to display each channel's power. To change any channel's power level, repeat Step 3 and Step 4 for that channel.

Step 6. Press the ▼ key until the display shows **MEAN FREQ PWR zzz W,** where zzz is the currently programmed power level for the mean frequency. The station keys on mean frequency in the Station Power Output Alignment Procedure, External Wattmeter Calibration, and UHSO Alignment Procedure in Section 14 – *Station Alignment*. To change the mean frequency power level, repeat Step 3 and Step 4.

Step 7. Press the **EXIT** key twice to return to the **READY** prompt.

Configuration Procedure (continued)

Transmitter Channel Carrier Offsets

The **TX CHN OFFSETS** menu has two parameters, **HIGH SPEED OFFSET** and **LOW SPEED OFFSET**, which let you set the transmit frequency carrier offsets. In a simulcast paging system, signal transmission performance can be improved when the frequency deviations of adjacent paging transmitters are offset by a given amount. Consult your systems engineer.

Use the table below to choose which carrier offset must be set for each type of paging data used in this station. Then use the procedure that follows to set the values.

Paging Data Type	Carrier Offset
POCSAG 2-level 1600 *FLEX*	**LOW SPEED OFFSET**
2-level 3200 *FLEX* 4-level *FLEX* ERMES	**HIGH SPEED OFFSET**

Step 1. From the **READY** prompt, press the **TX** key to enter the Transmit menu. The display shows **TX CHN FREQS**. Press the ▼ key until **TX CHN OFFSETS** is displayed.

Step 2. Press the **ENT** key. The display shows **HIGH SPEED OFFSET xxxx HZ**, where xxxx is the current high-speed carrier offset value.

Step 3. To change the high-speed carrier offset, press the **ENT** key. (Otherwise, go to Step 5.) The display shows **xxxx** (flashing), where xxxx is the current high-speed carrier offset value.

Step 4. Enter the new value for the field using the digit keys. The value range is from −5000 to +5000 Hz. To change the sign of the value, use the **TOG** key. (The negative sign appears on the display for a negative value, but no positive sign appears for a positive value.) Finally, press **ENT**. After you press **ENT**, the display shows **HIGH SPEED OFFSET yyyy HZ**, where yyyy is the newly entered value.

Step 5. To change the low-speed carrier offset, press the ▼ key. The display shows **LOW SPEED OFFSET xxxx HZ**, where xxxx is the current low-speed carrier offset value. Repeat Step 3 and Step 4 (the display will show **LOW** instead of **HIGH**).

Step 6. Press the **EXIT** key twice to return to the **READY** prompt.

Configuration Procedure (continued)

Low Speed Splatter Filter

The **LOW SPEED SPLATTER FILTER** parameter configures the station for compatibility with other paging transmitters in the same paging system. This parameter applies only to low-speed paging: POCSAG, GSC, and 1600 *FLEX* transmissions. It has no effect on high-speed paging; 3200 and 6400 *FLEX* and ERMES always use the 88 µs splatter filter.

Use the table below to choose which low speed splatter filter is correct for your system. Then use the procedure that follows to change the parameter if necessary.

Paging System	Low Speed Splatter Filter
Nucleus Stations only	**88 US LOW PASS**
Nucleus Station simulcast with 140 µs paging stations	**140 US LOW PASS**
Nucleus Station simulcast with 250 µs paging stations	**250 US LOW PASS**

Step 1. From the **READY** prompt, press the **TX** key to enter the Transmit menu. The display shows **TX CHN FREQS**. Press the ▼ key until **LOW SPEED SPLATTER FILTER: xxx US LOW PASS** is displayed, where xxx is 88, 140, or 250.

Step 2. Press the **ENT** key. The display shows **xxx US LOW PASS** (flashing), where xxx is 88, 140, or 250.

Step 3. Use the **TOG** key or the ▼ key to scroll through the choices for splatter filter. Press the **ENT** key to select a new value. The display shows **LOW SPEED SPLATTER FILTER: yyy US LOW PASS**, where yyy is the newly selected value.

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Nominal Binary Deviation

The **NOMINAL BINARY DEVIATION** parameter lets you change the binary deviation value for POCSAG and 1600 *FLEX* paging transmissions. Valid values range from 0 to 7000 Hz. (The binary deviation for 2-level 3200 *FLEX* transmissions is fixed at 4800 Hz.)

Step 1. From the **READY** prompt, press the **TX** key to enter the Transmit menu. The display shows **TX CHN FREQS**. Press the ▼ key until **NOMINAL BINARY DEVIATION xxxx HZ** is displayed, where xxxx is the current binary deviation value for the station.

Step 2. Press the **ENT** key. The display shows **xxxx HZ** (flashing) where xxxx is the current deviation value

Step 3. Enter the desired deviation value using the digit keys, followed by the **ENT** key. The display shows **NOMINAL BINARY DEVIATION yyyy HZ**, where yyyy is the newly entered value.Valid values are 0 to 7000 Hz, in 1 Hz increments.

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Configuration Procedure (continued)

Special Transmitter Setup

Tx Data Invert

The **TX DATA INVERT** parameter lets you configure the *Nucleus* station to invert paging data deviation. The tables below show normal deviation and inverted deviation at the transmitter output. To invert paging data, use the procedure that follows to set **TX DATA INVERT** to **ENABLED**.

Paging Data Type	Symbol	Normal Carrier Deviation
2-level *FLEX*, POCSAG, GOLAY	1	Maximum Positive Deviation
	0	Maximum Negative Deviation
4-level *FLEX*, ERMES	10	Maximum Positive Deviation
	11	Inner Positive Deviation
	01	Inner Negative Deviation
	00	Maximum Negative Deviation

Paging Data Type	Symbol	Inverted Carrier Deviation
2-level *FLEX*, POCSAG, GOLAY	1	Maximum Negative Deviation
	0	Maximum Positive Deviation
4-level *FLEX*, ERMES	10	Maximum Negative Deviation
	11	Inner Negative Deviation
	01	Inner Positive Deviation
	00	Maximum Positive Deviation

Step 1. From the **READY** prompt, press the **TX** key to enter the Transmit menu. The display shows **TX CHN FREQS**. Press the ▼ key until **SPECIAL TX SETUP** is displayed.

Step 2. Press the **ENT** key. The display shows **TX DATA INVERT: DISABLED** (or **: ENABLED**).

Step 3. Press the **ENT** key. The display shows **DISABLED** (or **ENABLED**) (flashing).

Step 4. Press the **TOG** key to change the setting, followed by **ENT**. The display shows **TX DATA INVERT: ENABLED** (or **: DISABLED**).

Step 5. Press the **EXIT** key twice to return to the **READY** prompt.

Configuration Procedure (continued)

Special Transmitter Setup (continued)

Tx = Rx

If a co-located monitor receiver is tuned to the same frequency as the station transmitter, desensitization of the receiver may occur. To prevent this, set the **TX = RX** parameter to **ENABLED**. This causes transmit channel 1 to switch to a frequency 100 kHz off the transmit frequency whenever the transmitter is not keyed.

Note that the transmit frequency that is equal to the monitor receiver frequency must be assigned to transmit channel 1; the **TX = RX** parameter does not affect other transmit channels besides channel 1.

Step 1. From the **READY** prompt, press the **TX** key to enter the Transmit menu. The display shows **TX CHN FREQS**. Press the ▼ key until **SPECIAL TX SETUP** is displayed.

Step 2. Press the **ENT** key. The display shows **TX DATA INVERT: DISABLED** (or **: ENABLED**).

Step 3. Press the ▼ key. The display shows **TX = RX: DISABLED** (or **: ENABLED**).

Step 4. Press the **ENT** key. The display shows **DISABLED** (or **ENABLED**) (flashing).

Step 5. Press the **TOG** key to change the setting, followed by **ENT.** The display shows **TX = RX: ENABLED** (or **: DISABLED**).

Step 6. Press the **EXIT** key twice to return to the **READY** prompt.

Configuration Procedure (continued)

NOTE: *During station alignment procedures (as described in Section 14:* Station Alignment*), idle deviation is null, regardless of the* **IDLE DEVIATION** *setting.*

Idle Deviation

The **IDLE DEVIATION** parameter determines what the station transmit frequency is while the station is idle (keyed but not transmitting). This allows compatibility with other paging transmitters in the same paging system. Use the table below to choose which setting is correct for your system. Then use the procedure that follows to change the parameter if necessary.

IDLE DEVIATION Setting	Tx Frequency when Station is Idle
NULL	Current Channel Frequency
SPACE	Channel Frequency – NBD or 4800 Hz*
MARK	Channel Frequency + NBD or 4800 Hz*

* The **SPACE** (–) or **MARK** (+) deviation value is:
NBD (Nominal Binary Deviation) for POCSAG and 1600 *FLEX* paging data; or
4800 Hz for 3200 and 6400 *FLEX* paging data, or
4687.5 Hz for ERMES paging data.

Step 1. From the **READY** prompt, press the **TX** key to enter the Transmit menu. The display shows **TX CHN FREQS**. Press the ▼ key until **IDLE DEVIATION: NULL** (or **: SPACE** or **: MARK**) is displayed.

Step 2. Press the **ENT** key. The display shows **NULL** (or **SPACE** or **MARK**) (flashing).

Step 3. Use the **TOG** key or the ▼ key to scroll through the choices (**NULL**, **SPACE** and **MARK**). Press the **ENT** key to select a new value. The display shows **IDLE DEVIATION: SPACE** (or **: MARK** or **: NULL**).

Step 4. Press the **EXIT** key to return to the **READY** prompt.

External Wattmeter Type

The **EXT WATTMETER TYPE** parameter configures the station for use with an External Circulator (Option X676 or Option X677). The parameter should be set to **CLASS 1** if the station has either of these options. **CLASS 1** (Motorola) is the only type currently supported.

Step 1. From the **READY** prompt, press the **CNFG** key to enter the Station Configuration menu. Press the ▼ key until **EXT WATTMETER TYPE: NONE** (or **: CLASS 1 EXT**) is displayed.

Step 2. Press the **ENT** key. The display shows **NONE** (or **CLASS 1 EXT**, etc.) (flashing).

Step 3. To change the setting, use the **TOG** key or the ▼ key to scroll through the menu choices. Press the **ENT** key to select a new choice. The display shows **EXT WATTMETER TYPE: CLASS 1 EXT** (or **: NONE**).

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Configuration Procedure (continued)

CAUTION

The **ANTENNA RELAY** and **EXT CIRCULATOR** parameters are set at the factory when the corresponding options are ordered with the *Nucleus* Paging Station. ***Do not*** change these parameters unless you are certain the change should be made. Incorrect configuration of these parameters can cause catastrophic damage to the paging station.

CAUTION

The alignment channels (**ALIGN 1 VCO**, etc.) can be displayed using the **CURRENT TX CHN** parameter, but are automatically selected during alignment procedures using the Station Alignment menu. ***Do not*** attempt to select any of the alignment channels using the **CURRENT TX CHN** parameter.

Antenna Relay

The **ANTENNA RELAY** parameter configures the station for use with the Antenna Relay (Option X371). The parameter should be set to **ENABLED** if an Antenna Relay is installed; **DISABLED** if not installed.

Step 1. From the **READY** prompt, press the **OPT1** key to enter the Station Options 1 menu. The display shows **ANTENNA RELAY: ENABLED** (or **: DISABLED**).

Step 2. Press the **ENT** key. The display shows **ENABLED** (or **DISABLED**) (flashing).

Step 3. To change the setting, press the **TOG** key, followed by **ENT**. The display shows **ANTENNA RELAY: DISABLED** (or **ENABLED**). (Refer to **CAUTION** at left.)

Step 4. Press the **EXIT** key to return to the **READY** prompt.

External Circulator

The **EXT CIRCULATOR** parameter configures the station for use with an External Circulator (Option X676 or Option X677). The parameter should be set to **PRESENT** if an External Circulator is installed; **NOT PRESENT** if not installed.

Step 1. From the **READY** prompt, press the **OPT1** key to enter the Station Options 1 menu. The display shows **ANTENNA RELAY: ENABLED** (or **: DISABLED**). Press the ▼ key until **EXT CIRCULATOR: NOT PRESENT** (or **: PRESENT**) is displayed.

Step 2. Press the **ENT** key. The display shows **NOT PRESENT** (or **PRESENT**) (flashing).

Step 3. To change the setting, press the **TOG** key, followed by **ENT**. The display shows **EXT CIRCULATOR: PRESENT** (or **: NOT PRESENT**). (Refer to **CAUTION** at left.)

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Current Transmit Channel

The **CURRENT TX CHN** parameter displays the current transmit channel for the station, and lets you change the channel to any value from 1 to 32.

Step 1. From the **READY** prompt, press the **STN** key to enter the Station menu. The display shows **TX FREQ RANGE**. Press the ▼ key until **CURRENT TX CHN: xx** is displayed. The value xx is the current transmit channel.

Step 2. To change the transmit channel, press the **ENT** key. The display shows **xx** (flashing), where xx is the current transmit channel.

Step 3. Use the **TOG** key, ▲ key, or ▼ key to scroll through the choices for transmit channel (from 1 to 32). Press the **ENT** key to select a new value. The display shows **CURRENT TX CHN: yy**, where yy is the new transmit channel.

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Configuration Procedure (continued)

CAUTION

If your station does not have an internal Receiver Module, the **RX TYPE** parameter is set to **NO INTERNAL**. ***Do not*** change the parameter to **INTERNAL LINK** or **INTERNAL MONITOR** if there is no Receiver Module in the station.

Receiver Type

The **RX TYPE** parameter configures the station internal Receiver Module, if one is present. (The same Receiver Module can be configured either as a link receiver or as a monitor receiver.)

The **RX TYPE** parameter is set in the factory based on the Receiver Module option ordered with the station. If the Receiver Module is to be used as a link receiver, the parameter should be set to **INTERNAL LINK**. If the Receiver Module is to be used as a monitor receiver, the parameter should be set to **INTERNAL MONITOR**. If there is no Receiver Module, the parameter should be set to **NO INTERNAL**.

To change the setting from **INTERNAL LINK** to **INTERNAL MONITOR** (or vice versa), use the following procedure.

Step 1. From the **READY** prompt, press the **CNFG** key to enter the Station Configuration menu. Press the ▼ key until **RX TYPE: INTERNAL LINK** is displayed.

Step 2. Press the **ENT** key. The display shows **INTERNAL LINK** (flashing).

Step 3. Press the **TOG** key or the ▼ key until **INTERNAL MONITOR** is displayed (flashing). Press the **ENT** key. The display shows **RX TYPE: INTERNAL MONITOR**.

Step 4. Press the **EXIT** key to return to the **READY** prompt.

If you install a Receiver Module into the station, change the setting from **NO INTERNAL** to **INTERNAL LINK** or **INTERNAL MONITOR**. (See **CAUTION** at left.)

Step 1. From the **READY** prompt, press the **CNFG** key to enter the Station Configuration menu. Press the ▼ key until **RX TYPE: NO INTERNAL** is displayed.

Step 2. Press the **ENT** key. The display shows **NO INTERNAL** (flashing).

Step 3. Press the **TOG** key or the ▼ key until **INTERNAL LINK**. or **INTERNAL MONITOR** is displayed (flashing). Press the **ENT** key to make the selection. The display shows **RX TYPE: INTERNAL LINK** (or **: INTERNAL MONITOR**).

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Step 5. If you changed from **RX TYPE: NO INTERNAL** to **: INTERNAL LINK** or **: INTERNAL MONITOR**, you must reset the station. Press the **1** key and the **3** key simultaneously.

Configuration Procedure (continued)

Receiver Frequency Range

Use the **RX FREQ RANGE** parameter (read-only) to verify the station Receiver Module frequency range, if a Receiver Module is installed. (The Receiver Module has a range ID which the Station Control Module will read and display.)

From the **READY** prompt, press the **RX** key to enter the Receiver menu. *The* **RX TYPE** *parameter on the Configuration Menu must be set to* **INTERNAL LINK** *or* **INTERNAL MONITOR** *in order to access the Receiver Menu.* The display shows **RX FREQ RANGE: xxx–yyy MHZ**, where xxx–yyy is the frequency range (in MHz) of the station Receiver Module.

Receiver Channel Frequency

The **RX CHN FREQ** parameter lets you set the Receiver Module channel frequency.

Step 1. From the **READY** prompt, press the **RX** key to enter the Receiver menu. The display shows **RX FREQ RANGE: xxx–yyy MHZ**. Press the ▼ key until **RX CHN FREQ xxx.xxxx MHZ** is displayed, where xxx.xxxx is the currently programmed frequency for the receiver channel.

Step 2. Press the **ENT** key. The display shows **xxx.xxxx** (flashing) where xxx.xxxx is the current value for the field.

Step 3. Enter the new value for the field using the digit keys, followed by **ENT**. The frequency is displayed in MHz, with four places to the right of the decimal point. The decimal point is fixed, so as each new digit is entered, the previously entered digits move to the left. After you press **ENT**, the display shows **RX CHN FREQ yyy.yyyy MHZ**, where yyy.yyyy is the newly entered value.

For example, to set the channel for 922.6250 MHz, enter the digits **9226250** and press **ENT**. The display shows **RX CHN FREQ 922.6250 MHZ**.

Step 4. Press the **EXIT** key to return to the **READY** prompt.

IMPORTANT

If you enter a value for **RX CHN FREQ** that is not valid, the value will not be accepted when you press the **ENT** key. The previous value will remain. Be sure to check the display to make sure that the new value has been accepted.

Configuration Procedure (continued)

Receiver Channel Spacing

The **CHN SPACING** parameter lets you choose the receiver channel spacing. This sets the amount of bandwidth above and below the receiver channel frequency. The available choices depend on the frequency range of the Receiver Module, and are displayed in Step 1 below. Many bands have only one choice. Some have more than one (for example, 12.5 kHz and 25 kHz).

Step 1. From the **READY** prompt, press the **RX** key to enter the Receiver menu. The display shows **RX FREQ RANGE: xxx–yyy MHZ**. Press the ▼ key until **CHN SPACING: xx.x KHZ** is displayed, where xx.x is the current channel spacing value.

Step 2. Press the **ENT** key. The display shows **xx.x KHZ** (flashing), where xxx is the current channel spacing value.

Step 3. Use the **TOG** key or the ▼ key to scroll through the choices for the channel spacing. Press the **ENT** key to select a new value. The display shows **CHN SPACING: yy.y KHZ**, where yy.y is the newly selected channel spacing value.

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Receiver Deemphasis

The **RX DEEMPHASIS** parameter lets you enable or disable deemphasis for the Receiver Module. In most cases, the parameter should be **DISABLED**, producing "flat" audio response (for example, for link applications, or if used as a monitor receiver with an Internal NIU). The parameter should be enabled only to measure EIA sensitivity, or if used as a monitor receiver without an Internal NIU.

Step 1. From the **READY** prompt, press the **RX** key to enter the Receiver menu. The display shows **RX FREQ RANGE: xxx–yyy MHZ**. Press the ▼ key until **RX DEEMPHASIS: DISABLED** (or **: ENABLED**) is displayed.

Step 2. Press the **ENT** key. The display shows **DISABLED** (or **ENABLED**) (flashing).

Step 3. Press the **TOG** key to change the setting, followed by **ENT**. The display shows **RX DEEMPHASIS: ENABLED** (or **: DISABLED**).

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Configuration Procedure (continued)

Receiver Output

The **RX OUTPUT** parameter lets you select whether the receiver output is inverted or not inverted. If **NOT INVERTED** is selected, then an increasing rf frequency produces an increasing voltage out of the receiver. If **INVERTED** is selected, then an increasing rf frequency produces a decreasing voltage out of the receiver (i.e., the audio or TTL output of the receiver is inverted).

The **RX OUTPUT** parameter should be left in the default state **NOT INVERTED** unless this receiver is being used as a monitor receiver with an NIU in a mixed system having non-*Nucleus* monitor receivers feeding NIUs. In this case the **RX OUTPUT** state should match the inversion state of the other NIU monitor receivers. If the other monitor receivers in the system are *Micor* or *PURC 5000*, the **RX OUTPUT** state should be set according to the following table.

Micor/PURC 5000 NIU Monitor Rx Band	RX OUTPUT Setting
132–150.8 MHz	**NOT INVERTED**
All other bands	**INVERTED**

Step 1. From the **READY** prompt, press the **RX** key to enter the Receiver menu. The display shows **RX FREQ RANGE: xxx–yyy MHZ**. Press the ▼ key until **RX OUTPUT: INVERTED** (or **: NOT INVERTED**) is displayed.

Step 2. Press the **ENT** key. The display shows **INVERTED** (or **NOT INVERTED**) (flashing).

Step 3. Press the **TOG** key to change the setting, followed by **ENT**. The display shows **RX OUTPUT: NOT INVERTED** (or **: INVERTED**).

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Monitor Receiver Output

The **MONITOR RX OUTPUT** parameter is used if the Receiver Module is configured as a monitor receiver (using the **RX TYPE** parameter on the Configuration menu). Select **TTL** if the monitor receiver is to be used with an NIU. This runs the analog audio through a limiter circuit, producing TTL-level 0 to 5 V output.

Step 1. From the **READY** prompt, press the **RX** key to enter the Receiver menu. The display shows **RX FREQ RANGE: xxx–yyy MHZ**. Press the ▼ key until **MONITOR RX OUTPUT: ANALOG** (or **: TTL**) is displayed.

Step 2. Press the **ENT** key. The display shows **ANALOG** (or **TTL**) (flashing).

Step 3. Press the **TOG** key to change the setting, followed by **ENT**. The display shows **MONITOR RX OUTPUT: TTL** (or **: ANALOG**).

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Configuration Procedure (continued)

Battery Revert Setup

If ac power fails, the station reverts to battery power if it is equipped with Option X30 or Option X43. The **BATTERY REVERT SETUP** menu lets you verify or set the battery revert options.

Battery Type

This entry lets you set the battery type used for backup. **SEALED LEAD CALCIUM** is the only battery type currently supported. **BATTERY REVERT DISABLED** is the setting for stations not equipped with battery backup.

Charging

This entry enables the station to charge the battery. **ENABLED** is the default setting. Select **DISABLED** if the battery will be charged by an external source.

Backup

This entry tells the station which backup mode to go into when an AC FAIL condition is detected and the station goes into battery revert. **BACKUP STATION** is the setting for a station ordered with Option X43. **BACKUP CONTROL** is the setting for a station ordered with Option X30.

If **BACKUP STATION** is the setting, the station continues to key during battery revert. Final power output is reduced, based on battery voltage level and fixed cutback reduction percentage (selected in the **FIXED CUTBK RED** field).

If **BACKUP CONTROL** is the setting, station keying is disabled during battery revert, but power to the Station Control Module is maintained. This retains station memory and continues communications with the paging system control point.

Fixed Cutback Reduction %

If **BACKUP STATION** is selected, final power output is reduced by the fixed cutback reduction percentage during battery revert. (Final power output may be reduced even more if battery power is low.)

Procedure

Step 1. From the **READY** prompt, press the **CNFG** key to enter the Station Configuration menu. Press the ▼ key until **BATTERY REVERT SETUP** is displayed.

Step 2. Press the **ENT** key. If the station is equipped with a battery revert option, the display shows **BATTERY TYPE: SEALED LEAD CALCIUM**.

Step 3. Press the ▼ key once. The display shows **CHARGING: ENABLED**. To change this setting (for external battery charging), press the **ENT** key, followed by the **TOG** key, followed by the **ENT** key. The display shows **CHARGING: DISABLED**.

Step 4. Press the ▼ key once. The display shows **BACKUP: BACKUP STATION** or **BACKUP: BACKUP CONTROL**.

(Procedure continued on next page)

Configuration Procedure (continued)

Step 5. If the display shows **BACKUP: BACKUP CONTROL**, press the **EXIT** key twice to return to the **READY** prompt. If the display shows **BACKUP: BACKUP STATION**, press the ▼ key once. The display shows **FIXED CUTBK RED xx %**.

Step 6. To change the fixed cutback reduction percentage, press the **ENT** key. The display shows **xx** (flashing), where xx is the current value.

Step 7. Enter the new value using the digit keys, followed by **ENT**. The display shows **FIXED CUTBK RED yy %**, where yy is the newly entered value.

Step 8. Press the **EXIT** key twice to return to the **READY** prompt.

Set Station Time

The **SET STATION TIME** parameter lets you set the station date and time. The date defaults to 4/1/1993 (April 1, 1993). Station time is maintained by an internal battery for up to two days if power is not applied. The date and time values are used to time-stamp error log entries.

Step 1. From the **READY** prompt, press the **STN** key to enter the Station menu. Press the ▼ key until **SET STATION TIME** is displayed.

Step 2. Press the **ENT** key. The display shows **YEAR xxxx**, where xxxx is the current value for the year field.

Step 3. Press the **ENT** key. The display shows **xxxx** (flashing), where xxxx is the current value for the field.

Step 4. Enter the new value for the field using the keypad digit keys, followed by **ENT**. The display shows **YEAR yyyy**, where yyyy is the newly entered value.

Step 5. Press the ▼ key to move to the next field (**MONTH**, **DAY**, **HOUR**, **MINUTE**, **SECOND**), repeating Step 3 and Step 4 until all values are set.

Step 6. Press the **EXIT** key twice to return to the **READY** prompt.

System Timer Alarm

The **SYS TIMER ALRM** parameter lets you select the system timer alarm threshold (or disable the system timer). The system timer is reset every time the station keys. If the station does not key for a period of time longer than the system timer alarm threshold, the alarm is set. Selectable values range from 2 to 180 minutes.

Step 1. From the **READY** prompt, press the **STN** key to enter the Station menu. Press the ▼ key until **SYS TIMER ALRM: DISABLE** (or **xxx MIN**) is displayed.

Step 2. Press the **ENT** key. The display shows **DISABLE** (or **xxx MIN**) (flashing), where xxx is the current value for the field.

Step 3. Use the **TOG** key or the ▼ key to scroll through the choices for system timer delay period. Press the **ENT** key to select a new value. The display shows **SYS TIMER ALRM: yyy MIN**, where yyy is the newly selected value.

Step 4. Press the **EXIT** key to return to the **READY** prompt.

13 INTERNAL NIU CONFIGURATION

This section is devoted to configuring the Internal Network Interface Unit (NIU) and setting up its operating parameters. These procedures assume that paging data and diagnostic connections have been made as described in Sectin 7 and Section 9. (If your station has an external NIU, refer to the external NIU user manual.)

C-NET Synchronization

There are three types of paging system synchronization that can be used in a C-NET network:

- **Monitor Receiver Synchronization** – A monitor receiver monitors paging station transmissions for modulation characteristics. When misaligned modulation is detected, it is reported back to the control point (CIU) by a dial-up phone line. The control point then takes corrective action to restore synchronization.
- **Direct Synchronization (with Digital Satellite Link)** – A monitor receiver is used for setup only but not for synchronization. Delay values are entered once manually and synchronization is maintained by timing signals embedded in the C-NET data stream. The NIU in the paging station compares the C-NET data stream timing signals to the NIU reference oscillator, and generates a correction voltage which maintains synchronization between the two signals.
- **GPS Synchronization (Self-Synchronization)** – A monitor receiver is used for setup only but not for synchronization. Delay values are entered once manually and synchronization is maintained by signals received from Global Positioning System (GPS) satellites.

The NIU must be configured to match the type of synchronization used by its paging system.

Use of NIU in C-NET Network

In a C-NET network, every paging transmitter has an NIU, which links the transmitter to the C-NET data stream. In addition, there are one or more Monitoring NIUs.

The Internal NIU in a *Nucleus* Paging Station can be used either as a paging transmitter NIU or as a Monitoring NIU, or as both:

- **Paging Transmitter NIU** – In this case, the Internal NIU interfaces the *Nucleus* Paging Station transmitter to the C-NET network. The NIU decodes the C-NET data stream for instructions and data addressed to it.
- **Monitoring NIU** – In this case, the Internal NIU monitors C-NET over-the-air (OTA) maintenance cycle transmissions from one or more paging transmitters, using the *Nucleus* Receiver Module configured as a monitor receiver. The Monitoring NIU is interfaced back to the control point (CIU) using a dial-up phone line. (The Option X437 Dial Modem must be installed on the Internal NIU.)

A single Internal NIU can be used as both a paging transmitter NIU and a Monitoring NIU. In this case, since the Receiver Module is used as a monitor receiver, it cannot be used as a link receiver.

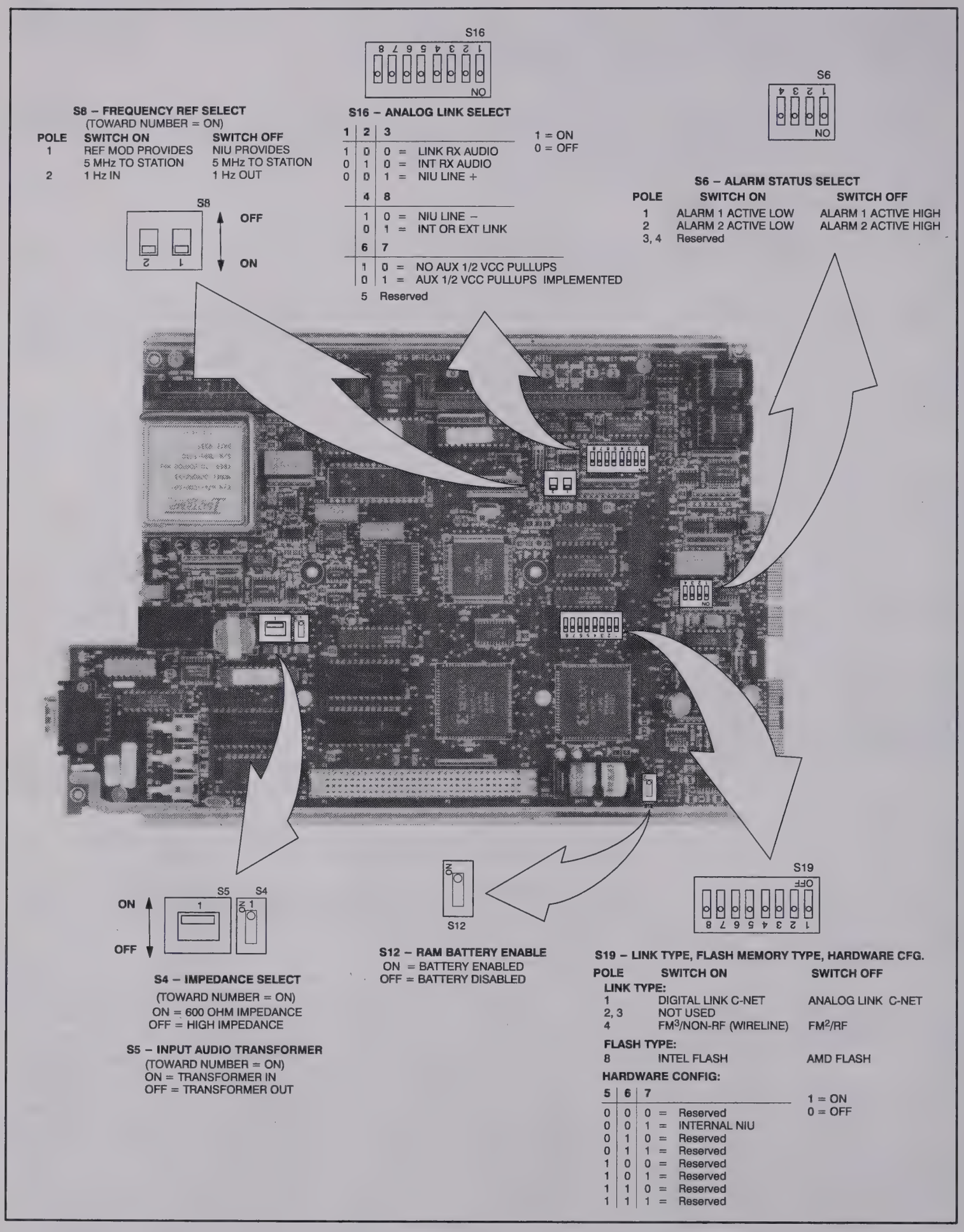


Figure 13–1. *Internal NIU DIP Switch Locations and Functions*

DIP Switch Settings

IMPORTANT

When using the Internal NIU as the station frequency reference, S8, pole 1 must be set to **OFF** (UP). When using a Reference Module with a UHSO or HSO as the station frequency reference, S8, pole 1 must be set to **ON** (DOWN).

In all cases, S8, pole 2 must be set to **ON** (DOWN).

The Internal NIU contains DIP switches which must be set during the procedures given in this section. Refer to Figure 13–1 for the locations of the switches and descriptions of their functions.

Wireline Interface (requires Link Modem Option X443)

Configure the Internal NIU for a wireline interface as follows (DIP switch settings are set in the factory per customer order; check the settings to verify):

Step 1. Set Internal NIU DIP switch S19 as follows:

- Pole 1 to OFF (Analog Link C-NET)
- Pole 4 to ON (FM^3/non-RF/Wireline)
- Pole 7 to ON (Internal NIU)

Step 2. Set Internal NIU DIP switch S16 as follows:

- Poles 1 and 2 OFF, pole 3 ON (NIU Line +)
- Pole 4 ON, pole 8 OFF (NIU Line −)

Step 3. If desired, set Internal NIU DIP switch S4 to ON to connect a 600 ohm load into the circuit.

Step 4. If desired, set Internal NIU DIP switch S5 to ON to connect an isolation transformer into the circuit.

Step 5. Use the ***set link*** command to set the link speed and type (speed = user-defined, type = non rf).

Step 6. Use the ***set level*** command to set the audio level.

NOTE: *Refer to* NIU Software Commands *in this section for usage of the* **set link** *and* **set level** *commands.*

Digital Downlink Receiver Interface (no modem required)

If a digital downlink receiver is used, configure the Internal NIU as follows (DIP switch settings are set in the factory per customer order; check the settings to verify):

Step 1. Set Internal NIU DIP switch S19 as follows:

- Pole 1 to ON (Digital Link C-NET)
- Pole 4 to ON for FM^3, or to OFF for FM^2
- Pole 7 to ON (Internal NIU)

Step 2. Use the ***set link*** command to select the appropriate link speed and type.

DIP Switch Settings (continued)

NOTE: *Refer to* NIU Software Commands *in this section for usage of the* **set link** *and* **set level** *commands.*

External (Analog) Link Receiver Interface (requires Link Modem Option X443)

If an external analog link receiver is used, configure the Internal NIU as follows (DIP switch settings are set in the factory per customer order; check the settings to verify):

Step 1. Set Internal NIU DIP switch S19 as follows:

- Pole 1 to OFF (Analog Link C-NET)
- Pole 4 to OFF (FM^2/RF)
- Pole 7 to ON (Internal NIU)

Step 2. Set Internal NIU DIP switch S16 as follows:

- Pole 1 to ON, poles 2 and 3 to OFF (Link Rx Audio)
- Pole 4 OFF, pole 8 ON (Int or Ext Link)

Step 3. Set Internal NIU DIP switch S4 to OFF (High Impedance).

Step 4. Set Internal NIU DIP switch S5 to OFF (Audio Transformer Out).

Step 5. Use the ***set link*** command to set the link speed and type (speed = user-defined, type = rf).

Step 6. Use the ***set level*** command to set the audio level.

DIP Switch Settings (continued)

Internal Link Receiver Interface (requires Link Modem Option X443)

If an internal Receiver Module is installed in the station, and it will be configured as a link receiver, configure the Internal NIU as follows (DIP switch settings are set in the factory per customer order; check the settings to verify):

Step 1. Set Internal NIU DIP switch S19 as follows:

- Pole 1 to OFF (Analog Link C-NET)
- Pole 4 to OFF (FM^2/RF)
- Pole 7 to ON (Internal NIU)

Step 2. Set Internal NIU DIP switch S16 as follows:

- Pole 1 to OFF, pole 2 to ON, pole 3 to OFF (Int Rx Audio)
- Pole 4 OFF, pole 8 ON (Int or Ext Link)

Step 3. Set Internal NIU DIP switch S4 to OFF (High Impedance).

Step 4. Set Internal NIU DIP switch S5 to OFF (Audio Transformer Out).

Step 5. Use the ***set link*** command to set the link speed and type (speed = user-defined, type = rf).

Step 6. Use the ***set level*** command to set the audio level.

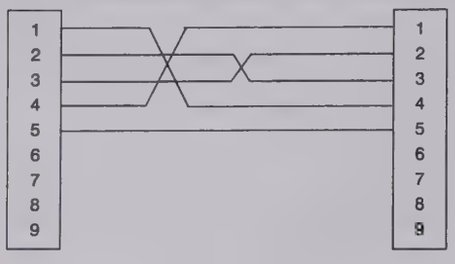
NOTE: *Refer to* NIU Software Commands *in this section for usage of the* **set link** *and* **set level** *commands.*

Auxiliary Outputs

When Internal NIU DIP switch S16, poles 6 and 7 are set to ON, 5 volt pullups are provided on the Auxiliary Output #1 and #2 lines. Auxiliary Output #1 is Backplane connector J17, pair 11, tip conductor (pin 36) (WC Out 1). Auxiliary Output #2 is Backplane connector J17, pair 12, tip conductor (pin 37) (WC Out 2).

Console User Interface

NIU Interface Cable Connections



The Console User Interface provides diagnostics and control over the NIU hardware and software. The interface requires a dumb terminal or terminal emulator program running on a computer with an RS-232 port.

Use an RS-232 cable to connect the terminal or computer to the **Console** DB-9 connector that protrudes through the *lower right corner* of the station Control front panel. For convenience, the cable should be approximately ten feet long. There are five connections required for the interface: RXD out (pin 2), TXD in (pin 3), DTR (pin 4), DCD (pin 1), and ground (pin 5). The illustration at the left shows a schematic diagram of the connections. The NIU must receive a valid Data Carrier Detect (DCD) signal before it will respond. The terminal or terminal emulator that is used should be set up for 19200 bps, 8 data bits, no parity, and 1 stop bit (19200, 8, N, 1).

A baud rate of 2400 should be used for remote access via the dial modem. Procomm Plus® (version 2.0 or later) for IBM PC compatibles, and White Knight® for the Apple Macintosh®, are the recommended terminal emulators.

Press <ENTER> on the keyboard to determine if the NIU is responding. The NIU will respond with:

[X] NUCNIU> Enter Password: _

Where **X** is the device number

On all devices, the password must be entered before you can gain access to the console interface. The password set from the factory is "COMPLEX". Type the password **complex** <ENTER>. The NIU will now respond with the **[X]NUCNIU>_** prompt.

NOTE: *The password for all NIUs in a system is maintained in the CIU. When the password is changed in the CIU, it is immediately updated for all devices on the network having the same system number as the CIU. The password is also updated each time the station ID is sent.*

If the interface is connected at the time of power-up, the following banner will be displayed on the screen:

```
C-NET Pt Advanced Paging Network
Copyright (c) 1990 by Complex Systems, Inc.
Copyright (c) 1984–1988 by Cellular Technology, Inc.
NVRAM:    JUN 15, 1993 9:34 AM
FLASH:    SEP 7, 1993 10:59 AM (SW Version)
ROM:      AUG 3, 1993 12:15 PM (SW Version)
NIU:      NUCLEUS
[ X]NUCNIU> Enter Password: _
```

This banner will also be displayed after resetting the station from the pushbutton switch on the NIU board, by pressing Station Control front panel keys 1 and 3 (**RESET**), or by entering the **reset unit** command.

IMPORTANT

If the screen displays a startup banner followed by a "%" sign, the NIU is running from ROM memory.

Console User Interface (continued)

The NIU power-up banner lists the software release date, version, and time of NV (non-volatile) RAM, FLASH, and ROM. NVRAM is a section of battery-backed RAM that is used to store and retain all programmable parameters. The NVRAM date is the date the NVRAM was initially formatted or was changed by revised FLASH memory software. The dates for FLASH and ROM are when each software versions were created. The dates may be different from each other. These dates can also be accessed by using the **show ver** command. The ROM software contains a subset of the commands available in the FLASH software. The ROM software provides download capability for updating software and allows the NIU to perform minimal functions in a paging system.

It is recommended that the FLASH software version be verified as current by calling the Motorola Global Paging Control Systems (GPCS) electronic bulletin board service (BBS). The BBS number is (817) 231-7200. Available baud rates are 300, 1200, 2400, 4800, and 9600. Set the modem software for 8 data bits, 1 stop bit, and no parity (N,8,1). The dates of the latest software versions are displayed in the BBS greeting message. An access code is required for FLASH memory downloads.

Flash memory software updates are downloaded through the **Console** port or over the C-NET data stream. It is not usually necessary to update the ROM memory after a FLASH memory update. If the ROM memory must be updated, it can be done later, usually when normal preventive maintenance procedures are performed.

To operate the Console User Interface, type commands and arguments, separated by spaces, at the **[X]NUCNIU>_** prompt, and execute them by striking the <ENTER> key. However, not all commands require arguments and some require only one or two.

The first word listed on each line of the **help *** display is the command. Listed in square brackets ([ ]) is a brief description of the command. The first input arguments for each command are listed in the braces ({}) and are separated by the "pipe" character (|). Typing only the command and return will display the list of first input arguments for that command. Typing the command and the first input argument lists the second argument for that command. Each command and input argument can be abbreviated by typing only the characters that are unique to the command and/or input argument. For example, the command **show alarm** can be abbreviated as **sh al**. Refer to the NIU Software Commands section in this manual for additional information on particular commands.

At power up, all devices have a power-up alarm indicated by the orange flashing **STATUS** front panel indicator.

Enter the **show alarm** command to verify that only the "powerfail/restart" alarm is in the "SET" condition (this condition is shown under the "latched" column on the alarm display). This alarm can be cleared by executing the **reset alarm** command. The **STATUS** front panel indicator should change from orange to green after alarm reset. After resetting the alarms, enter the **show alarm** command again and verify that the powerfail/restart alarm has also been cleared.

Table 13–1. Nucleus *NIU Software Commands*

Command & Options	Description
alarms	Set alarm parameters in NIU – Command will display alarms and prompt for alarm number to edit.
name	Change 20-character alarm name
mode	Sets state which causes the alarm to occur
range	Sets input voltage range, 5 V or 25 V
low-limit	Sets low voltage limit for external alarm input
hi-limit	Sets high voltage limit for external alarm input
debounce	Sets time required for alarm status to become valid
offset	Removes dc offset error to be removed from input measurement
key	Requires transmitter to be keyed before alarm becomes valid
inhibitors	Inhibits alarm if another specified alarm is also active
config	Configure NIU parameters
devid	Assigns ID number to each NIU
sysid	Sets system ID for entire simulcast system
name	Sets 20-character NIU name
tx_maint	Assigns maintenance group and channel to NIU
ota_maint	Sets NIU to monitor over-the-air maintenance information
password	Changes the system password
key_alarm	Configures alarm 1 for faulty transmitter key or normal analog input
nmu_key	Enables/disables Monitoring NIU to key transmitter upon reception of C-NET audio
zones	Sets transmitter group zones
id	Sets station Morse code ID for each transmit frequency
valid_chan	Selects frequency NIU will key on
txd	Sets NIU transmit data output to normal or inverted
pwr_strt	Sets NIU to key upon power-up or after sync
align	Sets alignment error tolerance for sync adjustments by NCU
cnet_stream	Sets the NIU C-NET data stream ID
date	Set time and date of NIU operation
flash	Switch from ROM memory to FLASH memory
help	Help menu – Typing "help" displays a list of commands; typing "help" followed by the software command name displays all options for that command
load	Install software via DB-9 **Console** front-panel connector (NIU must be running from ROM before entering command)
logout	Exit from user interface – returns to the "Enter Password" prompt
maint	Requests NCU maintenance cycle for Monitoring NIU
modem	Switch DB-9 **Console** front-panel connector to modem operation
report	Set OTA alarms and system maintenance reporting – displays report and prompts for report parameter to edit
report_phone#	Change or erase phone number used for dial-in reporting of alarms
auto_rpt	Enable/disable auto alarm reporting
alarm#'s	Add/delete alarms which will activate call-in function
events	Enable/disable event log reporting
max_trys	Set maximum number of dial-in reporting tries per hour
dial_type	Select pulse or tone dial type for internal modem
daily_call	Sets daily call-in time
ans_rings	Sets maximum number of rings for call-in attempt
adj_phone	Changes or erases phone number for dial-in reporting of maintenance information
min_adj_error	Sets tolerance for timing sync error
auto_adj	Enables/disables maintenance reporting function
reset	Resets parameter to its initial value
alarm	Resets all latched non-current alarms
log	Clears the NIU events log
nvram	Resets all parameters to default values
unit	Hardware reset, same as station reset or power-cycle
measure	Clears the measurement data in a Monitoring NIU
stats	Resets C-NET data statistics
call_atmps	Resets call attempt counter
adj_atmps	Resets max tries counter
all	Resets all parameters on this list ***except*** "unit" and "nvram"
modem	Resets modem, same as modem "ATZ" command
ph_stats	Resets phone statistics
iobd	Resets I/O board processor

Table 13–1. Nucleus *NIU Software Commands (continued)*

rom	Switch from FLASH memory to ROM memory
set	Sets state of hardware signals and software flags
key	Sets the output signal "KEY" active or inactive
dis	Enables/disables the NIU
ant	Sets the antenna relay control inactive or inactive
aux1	Sets the output signal "AUX1" active or inactive
aux2	Sets the output signal "AUX2" active or inactive
txfreq	Selects the transmitter frequency
rxfreq	Selects the receiver frequency
bps	Selects the data rate on the **Console** connector (300, 600, 1200, 2400, 4800, 9600, 19,200, 38,400, or 57,600)
link	Sets the type and speed of the C-NET link options
da	Sets the value of the D/A converter controlling the oscillator
hi_ber	Sets the upper bit error rate threshold
lo_ber	Sets the lower bit error rate threshold
cnet	Selects C-NET source (R96, digital)
cdig	Selects C-LAN digital input (R96, digital input)
cdigen	Enables the C-LAN digital output (rx, phone)
caud	Selects the C-LAN audio source
cauden	Sets the C-LAN audio source as an input or output
std5mhz	Selects the reference oscillator source (internal, external, external divided by 2)
lkclk	Selects the phase-locked loop lock source (internal, external)
level	Adjusts the C-NET audio level
con	Selects the maximum modem baud rate and autobaud capability
iobd	Selects the type of I/O board
txtype	Selects the transmitter type ID
resync	Causes the NIU to resync on the C-NET data stream
pullref	Sets the PLL to lock on previous reference after C-NET dropout
refcmp	Sets tolerance for PLL to lock on previous reference after C-NET dropout
maxwait	Sets the maximum rf link wait time
osc	Sets upper and lower frequency limits of 5 MHz oscillator range
align_type	Sets NIU synchronization method: (monitor, direct, or GPS)
link_delay	Sets the link delay (for direct synchronization or GPS synchronization only)
gps_delay	Sets GPS delay value (for GPS synchronization only)
show	Displays NIU settings and parameters
status	Displays various parameters and settings
alarms	Displays alarms and their status
log	Displays the contents of the event log
ver	Displays the software versions
config	Displays configuration parameters
measure	Displays maintenance measurement data
ota_alarms	Displays over-the-air alarm status
stats	Displays C-NET data statistics
flsh_sum	Displays checksum of FLASH memory
rom_sum	Displays checksum of ROM memory
analog	Displays the voltages of alarm inputs
report	Displays reporting setup
id	Displays all station IDs
dipsw	Displays S19 DIP switch settings
phone	Displays phone statistics
gps	Displays GPS receiver parameters
statid	Locally sets the station ID
sync	Adjusts NIU time delay sync (enter as: sync adjust [number of microseconds])
test	Performs NIU internal tests
end	End the current test
led	Tests board LED indicators
io	Tests the input and output lines
link	Tests the link modem
phase	Tests the phase detector circuit
da	Tests the digital-to-analog converter
txd	Sends data on selected transmitter channel
ota	Tests over-the-air measurement data
ber	Continuously displays the bit error rate
level	Continuously displays the C-NET audio level
forever	Runs current test forever (use "test end" to stop)
time	Displays elapsed time from NIU power-up or reset
trace	Displays NIU and system data to facilitate troubleshooting

NIU Software Commands

The following paragraphs provide detailed descriptions of each of the NIU software commands and their arguments. Shaded areas indicate actual screen displays.

ALARMS – Alarm Setup

The **alarms** command allows you to set up alarms in the NIU. Typing the command **alarms** and <ENTER> causes the NIU to go into the alarm setup mode and display the following screen:

```
                    20 char name   CURRENT ALARM SETTINGS

                                                  L-Limits-H Debounce Offset  Key  Inhibit
##  Alarm Name          Mode  Range               (V,W) (V,W)  (sec)    (m,V)  Req  If True
                                                                                    1 2 3 4
01  20 char name        diglo 5V                  0.80  2.00   2.00     90     ..   . . . .
02  20 char name        diglo 5V                  0.80  2.00   2.00     90     .    . . . .
03  not used in NUCLEUS
04  not used in NUCLEUS
05  not used in NUCLEUS
06  rx squelch          dighi 25V                 1.00  7.00   0.20     90
07  ram battery         a-in  5V                  0.00  2.90   2.00     90
08  not used in NUCLEUS
29  not used in NUCLEUS
enter alarm # (1,2,6, or 7) to edit:
```

The column in the alarm display labeled **##** is the alarm number. This number is fixed. Alarm numbers 1 and 2 are the user-programmable external alarms and alarm numbers 6 and 7 are the configurable internal alarms.

At the end of the alarm display, the NIU prompts for the alarm number to edit. Enter an alarm number (1, 2, 6, or 7). After the alarm number has been entered, the NIU responds with:

```
edit what (name|mode|range|low-limit|hi-limit|debounce|offset|key|inhibitors)
[X]enter:
```

The first line of the display lists all of the possible alarm edit commands that can be used. The number in the brackets is the alarm number currently being edited. To edit a different alarm, type <ENTER> at the above prompt and then enter the **alarm** command again. After entering the alarm number the NIU will be ready for input of an alarm edit command.

There are only four edit commands allowed for alarms 6 and 7; high and low limits, debounce, and offset. The following paragraphs describe in detail each of the alarm edit commands. Each of these commands must be entered from the alarm setup prompt.

NIU Software Commands (continued)

ALARMS – Alarm Setup (continued)

*The alarm **name*** is a 20-character name used for display and reporting purposes. The **name** parameter helps identify what the alarm input is connected to. To modify the name parameter, type **name** and <ENTER>. The NIU will respond with:

alarm name [1] 20 char name
new alarm name:

Enter the new name to be used for this alarm. After the new name has been entered, the NIU will respond with:

alarm name [1] = "new name"
edit what (name|mode|range|lowlimit|hilimit|debounce|offset|key|inhibits)

The NIU is now ready for the next alarm edit command.

*The alarm input **mode** command* indicates the state which causes an alarm to occur. To edit the mode, type **mode** at the **[X]enter**: prompt. The NIU will respond with:

mode what (diglo|dighi|a-in|a-out|p-in|p-out)
[1]enter:

The six possible alarm modes are as follows:

DIGLO	digital low state
DIGHI	digital high state
A-IN	analog voltage within the low and high limits
A-OUT	analog voltage outside the low and high limits
P-IN	power reading within the low and high limits
P-OUT	power reading outside the low and high limits

*The **range** command* sets the voltage input range for each alarm input. To edit the range, type **range** at the **[X]enter:** prompt. The NIU will respond with:

range what (5V|25V)
[X]enter:

The range can be set for either 5 V or 25 V. If a 25 V input is desired, you must supply an external voltage divider circuit. If 25 V is selected and the circuit is not present, the NIU will respond with:

!need ext scaling resistors!!

*The **low-limit** and **hi-limit** commands* set the voltage limits for each external alarm input. The limits are used to determine what voltage level will cause an alarm condition. The limits can be set by typing either **low-limit** or **hi-limit** commands at the prompt. The NIU will respond with either:

[X]enter low limit (mV or watts):
or,
[X]enter high limit (mV or watts):

The limits can be set from 0 volts to the **RANGE** setting.

NIU Software Commands (continued)

ALARMS – Alarm Setup (continued)

*The **debounce** command* sets the amount of time required for an alarm state to become valid. This filters out momentary glitches. To edit the debounce time, type **debounce**. The NIU will respond with:

[1]enter debounce (msec):

You can enter a debounce time in the range of 0 to 327,675 ms.

*The **offset** command* allows any DC-offset error to be removed from the input measurement. To change the offset, type **offset** at the prompt. The NIU will respond with:

[1]enter offset (mV):

You can enter an offset in the range of 0 to the **RANGE** setting.

*The **key** command* allows for the alarm to be qualified by the KEY output of the NIU. To edit the **key** parameter, type **key** at the **[X]enter:** prompt. The NIU will respond with:

Need TX key: (y/n)
[1]enter:

By typing **yes** at the prompt the alarm can be qualified with the TXKEY output. This means that both the TXKEY output (transmitter key) and the alarm input must be active for an alarm to be valid.

*The **inhibitors** command* allows you to inhibit an alarm if one of the other alarm inputs (1–4) is also active. This allows alarms such as the low rf output power to be detected without reporting other alarms that occur due to the low rf power condition. To edit, type **inhibitors**. The NIU will respond with:

Should one of the other alarm inputs [1–2] inhibit this alarm?
inh what (add|delete)
[X]enter:

You can now input either add or delete an alarm. The NIU will respond with one of the two prompts:

[X]add inhibitors (space between):
or,
[X]delete inhibitors (space between):

You can now enter the alarm inputs that are to be used, or not used, to inhibit the alarm. The same alarm input is not allowed.

NIU Software Commands (continued)

CONFIG – Configure

*The **config** command* allows you to set up the specific parameters which uniquely identify each NIU. The **show config** command is used to display all of the config parameters. The following is the output to the screen for the **show config** command for the NIU:

```
DEVICE NAME:        Lab Test
TIME & DATE:        19:15:23  01-01-1988
SYSTEM ID:          2
DEVICE ID:          1
VALID ZONES:        0
TX MAINT GRP:       Set     Group          Chan
                    1       0              1
                    2       Not defined
VALID TX CHAN:      1 2
TX DATA POL:        norm
PWR STARTUP:        yes
ALIGN DIST          100 uS
ANT OUTPUT:         tx/rx relay
ALARM 1 USE:        norm

OTA MAINT GROUPS:
GROUP   DEVICE   AIR DELAY   LOG OTA
  0      1000      0 uS        yes
  1       101      135 uS      no
```

The following paragraphs describe in detail each of the **config** commands for the NIU.

Device name (DEVICE NAME:) is a 20-character name used for display and reporting. The **name** command helps identify the device by location name rather than using the device number. After the **config name** command is entered, the NIU will respond with:

```
name = <current device name>
Enter new name:_
```

After the new name (up to 20 characters) is entered, the NIU will respond with:

```
name = <new device name>
```

System number (SYSTEM ID:) is used to uniquely identify the source and destination for all data coming from a single paging terminal output encoder. System numbers need to match for an entire simulcast system. The range of systems numbers is from 1 to 255. The system number can be changed by using the **config sysid** command. The NIU will respond with:

```
Enter new system (0–255):
```

Caution: 0 is not a valid system ID for *Nucleus* C-NET equipment.

NIU Software Commands (continued)

CONFIG – Configure (continued)

Device number (DEVICE ID:) allows you to give each NIU a unique identification number. The device number allows the NCU to issue commands that pertain only to a unique NIU. There are 8192 device IDs available. All units (including NCUs, NIUs, and CIUs) should have a unique device number. The device number can be changed by using the **config devid** command. The NIU will respond with:

devid = <current device ID number>
Enter new device (0–8191):

After the new device ID is entered, the NIU will respond with:

devid = <new device ID>

Valid channel (VALID CHAN:) is used to select which frequency the NIU will key on. The valid channel parameter allows the use of multiple channels without having to have all the base stations in the system programmed for the other channels. To set the channel map, use the command **config valid_chan**. The NIU will respond with:

valid chan what (add|delete|list)

If **add** is selected, the NIU will respond with:

Channel to add (1–16)

The NIU will respond similarly to the **delete** option and will provide a list of current valid channels in response to the list option.

TX maintenance group (TX MAINT GRP:) is used to assign each NIU to a specified maintenance group. The maintenance cycle is initiated by the CIU. A maintenance cycle consist of commands that tell all NIUs programmed in maintenance group "X" to keyup and send the maintenance data. The maintenance cycle starts with maintenance group 0 and ends with maintenance group 31. Multiple NIUs can be assigned the same maintenance group in a given system, provided they do not report to the same monitor receiver. If a system contains more than 32 transmitters, a second monitor receiver site is required. The maintenance group can be set with the **config tx_maint** command. The NIU will respond with:

Set Group Chan
1 group# chan#
2 group# chan#
tx_maint what (add|delete|list)

If **add** is selected, the NIU will respond with the current maintenance group for the paging transmitter:

tx_maint set to change (1–2)=

NIU Software Commands (continued)

CONFIG – Configure (continued)

After the maintenance set number is entered, the NIU will prompt for the maintenance group:

Enter new maint group (0–31)

After the maintenance group is entered, the NIU will prompt for the transmit channel:

Maint chan – (1–16):

If **delete** is selected at the **tx_maint what** prompt, the NIU will prompt for the maintenance group to be deleted:

Tx_maint set to delete (1–2):

If **list** is selected, the NIU will respond with the current maintenance sets:

Set	Group	Chan
1	group#	chan#
2	group#	chan#

Zone map (VALID ZONES:) is used to configure zoning information. Zoning allows you to group transmitters together in smaller coverage areas. There are 32 zones available. The zones are set by the paging terminal via the auxiliary inputs to the CIU. To set the zone, type **config zones**. The NIU will respond with:

zones what: (add|delete|list)

If add is selected, the NIU will prompt:

zones to add (0–31):

The NIU will respond similarly to the delete option and will provide a list of current zones in response to the list option.

Transmit data polarity (TX DATA POL:) allows you to configure the TX data output in the NIU for invert or non-invert (norm). Use the **config txd** command to change the TX data polarity. The NIU will respond with:

Enter new TX polarity: (NORM, INV):

NIU Software Commands (continued)

CONFIG – Configure (continued)

Power startup (PWR STARTUP:) permits the NIU to be set for immediate keying on power-up, or to wait for a sync adjust command before keying. When simulcasting, the NIU should be set to wait for sync; when used in non-simulcast applications, it should be set for immediate keying. Type **config pwr_strt** to use this command. The NIU will respond with:

pwr_strt = yes/no
startup parm (no, yes)

Type **yes** to key immediately after power-up or **no** to key after sync adjustment.

Alignment distance (ALIGN DIST:) allows you to program the maximum delay change (sync adjustments from the CIU) that can be made without unkeying and losing data. Sync adjustments received from the CIU which are less than alignment distance will be delayed until paging traffic ceases. Sync adjustments larger then alignment distance will become effective immediately and will result in a temporary unkey of the transmitter. To set the alignment distance, type **config align**. The NIU will respond with:

align = <xxxx> uS
Force align dist (uS, 0 = always)0

Password allows you to change the NIU password. To change the password, type **config passwd** and the NIU will respond with:

Enter old password: <old password>
enter new password: <new password>

The default password (from the factory) is **complex**.

Config ota_maint (ota_maint groups) allows you to configure an NIU to act as a Monitoring NIU. Type **config ota_maint** and the NIU will respond with:

ota_maint what (add|delete|list)

If **add** is selected, the NIU will prompt:

group to add (0–31):

NOTE: *The password for all NIUs in a system is maintained in the CIU. When the password is changed in the CIU, it is immediately updated for all devices on the network having the same system number as the CIU. The password is also updated each time the station ID is sent.*

NIU Software Commands (continued)

CONFIG – Configure (continued)

After entering the maintenance group number and <ENTER> the NIU will request the NIU device number:

NIU device (0–8191):

After entering the NIU device number, the NIU will prompt for the air delay time from station to monitor receiver:

Air delay in uS (0–50000):

After entering the air delay, the NIU will respond:

Log OTA items (n/y):

Type **no** if the reporting NIUs measurement parameters automatic report function is enabled; otherwise type **yes**. Refer to the description of the **REPORT** command for additional information regarding alarm reporting (**report auto_rpt** command).

The **delete** response to the **ota_maint what (add|delete|list)** prompt will delete the specified maintenance group.

DATE – Set Calendar Date and Station Time

*The **date** command* allows you to program the time and date when a unit is configured and placed in service. The time and date is maintained for the system by the CIU. The time and date is updated over the C-NET data stream to all units receiving to the data stream. The update occurs when the time and date is changed and immediately after each station ID. The time and date can be set in an NIU, but it will change back to the time that the CIU is set for as soon as the next station ID occurs. To change the time and date use the **date** command. Type **date** <ENTER> and the NIU will respond with:

time is: 12:00:04 date is: 08-25-1993

new time/date? enter: hh:mm mm-dd-yy

Type in the new time and date as follows making sure to type all digits for the year:

12:00 09071993 <ENTER>

The NIU will respond by displaying the time and date that was set:

time is: 12:00:00 date is: 09-07-1993

NIU Software Commands (continued)

FLASH – Causes Execution of Software in Flash Memory

The flash command allows you to execute the software programmed in the FLASH memory. This command is used to switch to FLASH memory when the NIU is running in ROM. Under normal operating conditions, the NIU should be executing the FLASH memory. After entering the **flash** command, the NIU will respond with:

Are you sure!!! (y)es, if so.

After typing **yes**, the NIU will restart the same as it does after initial power-up and display the following:

```
CNET Pt Advanced Paging Network
Copyright (c) 1990 by Complex Systems, Inc.
Copyright (c) 1984–1988 by Cellular Technology, Inc.
NVRAM:      JAN 15, 1993 9:34 AM
FLASH:      SEP 7, 1993 10:59 AM (SW version)
ROM:        AUG 3, 1993 12:15 PM (SW version)
NIU:        NUCLEUS

NUCNIU>  Enter password: _
```

HELP – Display Help Information

The **help** command displays help information on each command for each piece of C-NET equipment. Help information for a particular command may be displayed by typing the command **help** followed by a space and the name of the command. The asterisk (*) argument in the **help** command is used as "wild card" character to display help information for all commands.

example:

help set

```
CMDS ARE:
COMMAND:  DESCRIPTION:
set       [set signal    ]  {key|dis|ant|auxuse|aux1|aux2|txfreq|
                             rxfreq|maint_ch|bps|link|da|r96|pll
                             cpuok|hi_ber|lo_ber|switch|cnet|
                             cdig|cdigen|caud|cauden|refout|std5mhz|
                             lkclk|daa|level|con|syncadj|iobd|txtype
                             resync}
```

The command **help** with no argument produces a short listing of commands, that is:

```
CMDS ARE:
alarms    help      maint     set       test
config    logout    modem     show      time
date      level     reset     statid    trace
report    rom       sync
```

NIU Software Commands (continued)

LOGOUT – Exit the User Interface

*The **logout** command* allows a user to exit from the user interface. After the command is executed, the NIU will display:

[X] NUCNIU> Enter Password: _

In order to enter any commands you must enter the correct password. The password from the factory is set to **complex**.

MAINT – Dial Out to CIU and Request Maintenance Cycle

The **maint** command allows you to request a maintenance cycle. The command is executed immediately when you have connected directly to the front panel Console connector of the NIU, or after modem hangup when modem access is used. After entering the **maint** command the NIU responds with:

Are you sure!!! (y)es, if so.

MODEM – Switch Console Port to Modem

The **modem** command allows you to utilize the NIU dial-modem when using a computer not equipped with a modem. Use <CTRL Z> to exit this mode.

REPORT – Set Up Reporting Parameters

The **report** command allows you to set up the alarm and system maintenance reporting from an NIU. Typing the command **report** and <ENTER> causes the NIU to go into the reporting setup mode. After entering the **report** command, the NIU responds with:

```
DEVICE [X] : 20 char string          Time/Date
report_phone#          : 20 char phone string
auto_rpt               : no
alarm#'s               : 31
events                 : no
max_trys               : 10
dial_type              : tone
daily_call             : 08:00:00
ans_rings              : 1
attempts used          :0
items to rep           :no

MEASUREMENT PARAMETERS
adj_phone              : 15
min_adj_error          : 30 uSec
auto_adj               : yes
attempts used          :0

editwhat (rept_phone#|auto_rpt|alarm#'s|events|max_trys|dial_type|daily_call|
ans_rings|adj_phone|min_adj_error|auto_adj)
```

NIU Software Commands (continued)

REPORT – Set Up Reporting Parameters (continued)

The bottom line of the display lists all of the possible report command arguments that can be used. The NIU is now ready for input of the report command arguments. The following paragraphs describe in detail each of the report commands. Each of these commands must be entered from the report setup prompt.

The **report_phone#** argument is a 20 character string phone number that is used in conjunction with the Hayes® "ATD" command for alarm reporting. To change the report phone number, type **report_phone#**. The NIU will respond with:

enter new report_phone# (or erase):

Enter up to a 20 character phone number or type **erase** to clear the number. A sequence of Hayes command dial modifiers may also be placed in the phone number. Contact Motorola GPCS for information regarding the valid modifiers for the internal dial-modem.

The **auto_rpt** argument allows you to enable or disable the automatic alarm reporting function.

auto dial reporting (y)es or (n)o:

Type **(y)es** to enable the automatic alarm reporting function or **(n)o** to disable it.

The **alarm#'s** is a list of alarms that cause the NIU to call-in and report when any one or more of them become valid. To enter alarm numbers in the list, type **alarm#'s**. The NIU will respond with:

alarm initiating call-in?
31
add or delete?

Enter **add** or **delete** at the above prompt and the NIU will respond with:

enter alarm #'s (up to 10 at a time):

Enter all alarms that are to initiate a dial out, with a space between each. If more than ten alarms are required, enter the first group of numbers and then type the **alarm#'s** again at the **edit what** prompt.

The **events** argument allows you to send the event log with the alarms when doing a report. To enable or disable this feature, type **events**. The NIU will respond with:

report events with alarm (y)es or (n)o?

Type **yes** or **no** at the above prompt.

NIU Software Commands (continued)

REPORT – Set Up Reporting Parameters (continued)

*The **max_trys** argument* allows you to set the number of attempts, per hour, the NIU will make at calling the console to report alarms. When max_trys is reached, the NIU will stop dialing out and set alarm number 18 (dial modem fail). The max_trys function limits the phone line usage if a wrong number is programmed or some other malfunction occurs. To set the maximum number of tries, type **max_trys**. The NIU will respond with:

enter max_trys:

Enter max_trys from 1 to 10. The number of attempts used can be reset with the **reset call_attempts** command.

The internal dial-modem can dial with either pulse or tone method. This is set with the **dial_type** argument. To select the dialing method, type **dial_type** and the NIU will respond with:

enter dial_type:

Enter **tone** or **pulse** at the above prompt.

*The **daily_call** argument* sets the time when alarm number 31 (daily call-in) occurs. To set the daily call time, type **daily_call** and the NIU will respond with:

enter daily_call (hour min sec OR none):

Enter the time with a space between each, hour, minute, and the second or to disable type **none**.

*The **adj_phone** argument* is a 20 character string phone number that is used in conjunction with the Hayes "ATD" command for maintenance reporting and should be set to the phone number for the CIU. To change the adjust phone #, type **adjust_phone**. The NIU will respond with:

enter new adj_phone (or erase): _

Enter up to a 20 character phone number or type **erase** to clear the number. A sequence of Hayes command dial modifiers may also be placed in the phone number. Contact Motorola GPCS for information regarding the valid modifiers for the internal dial-modem.

*The **min_adj_error** argument* allows you to set the allowable tolerances in system timing synchronization (for example, only adjust for differences greater than 30 uSec from specification). To set, type **min_adj_error** and the NIU will respond with:

enter min_adj_error: _

*The **auto_adj** argument* allows you to enable or disable the maintenance reporting function. To set, type **auto_adj** and the NIU will respond with:

auto adjust (y/n)

Type **yes** to enable the maintenance reporting function or **no** to disable it.

NIU Software Commands (continued)

RESET – Reset Parameters or Data

*The **reset** command* restores a parameter or data to its initial/reset condition. The reset command has 12 possible first arguments and no second arguments. Only the **reset unit** command has a displayed response. The following lists the arguments and their definition:

alarm	reset all latched non-current alarms
log	clears the events log
nvram	reset all parameters to default values
unit	hardware reset, same as toggling master reset switch
measure	clears the measurement data in a monitor NIU
stats	resets C-NET data statistics
call_attempts	reset call attempt counter
adj_atmps	resets max_trys counter
all	resets all parameters on this list except "nvram" and "unit"
modem	resets modem (same as modem "ATZ" command)
ph_stats	resets phone number statistics
iobd	reset I/O board processor

All **reset** commands respond with the ">" prompt after performing their operation except for the **reset unit** command. This command does a hardware reset on the NIU. After the **reset unit** command, the NIU responds:

shell: reset!!

After the hardware reset, the NIU displays the startup banner and ">" prompt as follows:

```
CNET Pt Advanced Paging Network
Copyright (c) 1990 by Complex Systems, Inc.
Copyright (c) 1984–1988 by Cellular Technology, Inc.
NVRAM:          JAN 15, 1993 9:34 AM
FLASH:          SEP 7, 1993 10:59 AM (SW version)
ROM:            AUG 3, 1993 12:15 PM (SW version)
NIU:            NUCLEUS

[  X]NUCNIU> Enter password: _
```

ROM – Causes Execution of software in ROM Memory

*The **rom** command* allows the NIU to start execution of the software in ROM. This command is normally used when downloading to a unit via the console port. After the **rom** command is entered, the NIU will reboot and display the startup banner and the "%" prompt as follows:

```
CNET Pt Advanced Paging Network
Copyright (c) 1990 by Complex Systems, Inc.
Copyright (c) 1984–1988 by Cellular Technology, Inc.
NVRAM:          JAN 15, 1993 9:34 AM
FLASH:          SEP 7, 1993 10:59 AM
ROM:            AUG 3, 1993 12:15 PM
NIU:            NUCLEUS

[  X]NUCNIU% Enter password: _
```

The "%" prompt indicates that the NIU is running from ROM memory.

NIU Software Commands (continued)

SET – Set Signal or Parameter

The set command sets the state of hardware signals and software flags. The following is a list of the **set** commands and a brief description of each:

Command	Description
key	Sets the output signal "KEY" active or inactive
dis	Enable/disables the NIU
aux1	Sets the output signal "AUX1" active or inactive
aux2	Sets the output signal "AUX2" active or inactive
txfreq	Selects the transmit frequency
rxfreq	Selects the receive frequency
maint_ch	Sets the NIU channel number (1–4)
bps	Sets the data rate on console port (**300**, **600**, **1200**, **2400**, **4800**, **9600**, **19200**, **38400**, or **57600**)
link	Sets the type and speed of the C-NET link options
da	Sets the value of the D/A converter controlling the oscillator
r96	For internal engineering use only
pll	For internal engineering use only
cpuok	For internal engineering use only
hi_ber	Sets the upper bit error rate threshold
lo_ber	Sets the lower bit error rate threshold
cnet	Selects C-NET source (**r96**, **clan**, **digital**)
cdig	Selects C-LAN digital input (**r96**, **digin**)
cdigen	Enables the C-LAN digital output
caud	Selects the C-LAN audio source (**rx**, **phone**)
cauden	Sets the C-LAN audio source as an input or output
std5mhz	Selects the reference oscillator source (**osc**, **ext**, **extd2**)
lkclk	Selects the phased-locked loop lock source (**int**, **ext**)
daa	For internal engineering use only
level	Adjusts the C-NET audio level
con	Selects the maximum modem baud rate and auto baud capability
iobd	Selects the type of I/O board
txtype	Set the transmitter type ID
resync	Causes the NIU to resync on the C-NET data stream
pullref	Sets the PLL to lock on previous reference after C-NET dropout
refcmp	Sets tolerance for PLL to lock on previous reference after C-NET dropout
maxwait	Sets the maximum rf link wait time
osc	Sets upper and lower frequency limits of 5 MHz oscillator range
align_type	Sets NIU synchronization method (monitor, direct, or GPS)
link_delay	Sets the link delay (for direct synchronization or GPS synchronization only)
gps_delay	Sets GPS delay value (for GPS synchronization only)

NIU Software Commands (continued)

SET – Set Signal or Parameter (continued)

*The **set key** command* allows you to select manual keying of the base station.

*The **set dis** command* allows you to disable an NIU capability to key a base station. It performs the same function as toggling the disable switch.

*The **set bps** command* sets the data rate for the front panel console port. To set the console port data rate, type **set bps <rate>**, where **<rate>** is one of the following: **300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600**. After changing the port data rate, the data rate for the dumb terminal or terminal emulation software on the PC must also be changed. If using Procomm Plus, use the <ALT P> command to change the data rate.

*The **set link** command* sets the C-NET link type and link speed parameters in non-volatile RAM. The link type is initially set by DIP switches on the NIU board. The **link type** argument will override the DIP switch setting. The DIP switch setting should match the NVRAM setting. All NIUs must have their data rate set to the same value.

*The **set da** command* allows you to adjust the value of the on-board NIU oscillator reference clock from 4.999985 MHz to 5.000015 MHz. To use this command, type **set da <xxxx>**, where **<xxxx>** is a value between 0 and 16383. A value of 0 will set the reference clock to 4.999985 MHz; a value of 16383 will set the reference clock to 5.000015 MHz.

*The **set cnet** command* allows you to select the C-NET input source. The source may be set to **r96**, **clan**, or **digital**.

*The **set cdig** command* allows you to select the C-LAN digital input source. The source input may set to **r96** or **digin**

*The **set cdigen** command* allows you to enable or disable the C-LAN digital output source.

*The **set caud** command* allows you to select the C-LAN audio source. The audio source may be set to **rx** or **phone**.

*The **set cauden** command* allows you to set the C-LAN audio source as an input or and output.

*The **set std5mhz*** command allows you to select the reference oscillator source. The source may be set to internal (**osc**), external (**ext**), or external frequency divided by 2 (**extd2**).

*The **set lkclk** command* allows you to select the phase-locked loop lock source. The source may be set to internal (**int**) or external (**ext**).

NIU Software Commands (continued)

SET – Set Signal or Parameter (continued)

*The **set level** command* allows you to adjust the C-NET audio level. After typing **set level**, the NIU will respond with:

```
ANAS/N: 14 dB  ANALVL: 12 dB
Adjusting level to –10 dB
ANAS/N: 14 dB  ANALVL: 10 dB
NUCNIU>
```

After entering the desired level, press <ENTER>. The NIU will respond with the new signal to noise ratio and the new level.

If the NIU could not set the specified level, it will respond with:

Couldn't achieve desired level dB

*The **set con** command* allows you to set the maximum modem baud rate and autobaud capability. Enter **set con** and the NIU will respond with:

```
Auto baud – ON
Max rate – 2400
modem = ATE0 B1 S0=1 Q1 V1 &D1
Auto baud (y/n) :
Enter new max rate (300, 1200, 2400) :
Enter new init string (40 characters max) :
Auto baud – ON
Max rate – 1200
modem = ATE0 B1 S0=1 Q1 V1 &D1
```

IMPORTANT

For *Nucleus* applications, the **set iobd** command must be set for **int_nuc**.

*The **set iobd** command* allows you to select the type of I/O board used with the NIU. Valid choices are **generic**, **jlb**, **acb**, **nucleus**, and **int_nuc**.

*The **set txtype** command* allows you to identify the transmitter type used with the NIU. Any ID name up to eight characters may be used. This command is for ID purposes only and does not affect NIU operation.

*The **set resync** command* forces the NIU to re-synchronize to the C-NET data stream.

*The **set pullref** command* allows you to enable the PLL to re-lock on its previous reference after a C-NET dropout, if the new reference is within the tolerance programmed by the **set refcmp** command. Type **set pullref 1** to enable this function and **set pullref 0** to disable it.

*The **set refcmp** command* allows you to program the frequency comparison tolerance which will allow the PLL reference to re-lock on the previous reference after a C-NET dropout. This tolerance is specified in cycles of the 4.77 MHz processor clock (number of microseconds divided by 4.77).

*The **set maxwait** command* allows you to set the maximum wait for rf links. Enter **set rfphs <xxxxx>**, where xxxxx is the maximum wait time.

*The **set osc** command* allows you to set upper and lower frequency limits of the 5 MHz oscillator range

NIU Software Commands (continued)

SET – Set Signal or Parameter (continued)

*The **set align_type** command* configures the NIU to match the synchronization method used by its paging system: monitor synchronization, direct synchronization, or GPS synchronization (**monitor**, **dir_sync**, or **gps**).

*The **set link_delay** command* (used for Direct Synchronization only) must be set uniquely for each NIU to coordinate simulcast transmission by all paging transmitters in a system. The parameter compensates for varying distances between the paging transmitter sites in the system and the corresponding geostationary satellite. The parameter specifies the amount of time (+ or −) the paging transmitter must wait before transmitting.

*The **set gps_delay** command* (used for GPS Synchronization only) must be set uniquely for each NIU to coordinate simulcast transmission by all paging transmitters in a system. The parameter compensates for varying transmission times through the paging transmitter sites in the system. The parameter specifies the amount of time (+ or −) the paging transmitter must wait before transmitting.

SHOW – Display Information

*The **show** command* displays different sets of information to the screen. The following is a list of the **show** commands and a brief description of each.

Command	Description
status	Displays various parameters and settings
alarm	Displays alarms and their status
log	Displays the event log
ver	Displays the software versions
config	Displays configuration parameters
measure	Displays maintenance measurement data
stats	Displays C-NET data statistics
flsh_sum	Displays checksum of FLASH memory
rom_sum	Displays checksum of ROM memory
analog	Displays the voltages of alarm inputs
report	Displays reporting setup
id	Displays all station IDs
dipsw	Displays S19 DIP switch settings
phone	Displays phone statistics
gps	Displays GPS receiver parameters

NIU Software Commands (continued)

SHOW – Display Information (continued)

*The **show status** command* displays setup and parameter values for the NIU. After entering he **show status** command, the NIU displays the following:

```
DEVICE 0   : 20 char string        TIME/DATE  04:22:03  01011988
KEY:       no      ANT:     rx      TXFREQ:   1        RXFREQ:    1
DIS:       maint   AUX1:    inact   AUX2:     inact    CNETOK:    no
CNET:      r96     R96:     rx      CDIG:     r96      CAUD:      rx
LNKTYPE:   rf      LNKSPD:  9600    CDIGEN:   yes      CAUDDIR:   output
FSYNC:     no      DA:      8192    PLL:      no       WT:        500
ANA-S/N:   14 dB   ANA-LVL: -14 dB  STREAM:   32767    BER:       0 E-06
DIPSW:     0x7f    CPUOK:   yes
IO-BD      int_nuc TX-TYPE: Nucleus MT-REQ    00:00:00 01-01-1988
[  X] NUCNIU> _
```

The following lists each item from the **show status** display with a brief description:

KEY:	Indicates the state of the KEY output (0 = inactive, 1 = active)
AUX1:	Indicates the state of AUX1 (active = low, inactive = high)
AUX2:	Indicates the state of AUX2 (active = low, inactive = high)
DIS:	Indicates transmitter output disable state (0 = enabled, 1 = disabled)
CPUOK:	Indicates the state of the watchdog timer circuit (0 = timed out, 1 = ok)
R96:	Indicates what audio interface is feeding the R96 modem (RX, C-LAN, Lpback)
TX TYPE:	Indicates what type of unit it is set for (dip switch, NIU)
DIPSW:	Displays (in hexadecimal) what is read from the four-position DIP switch
DA:	Displays the current setting for the DAC that drives the VCO
PLL:	Indicates if the C-NET PLL is in lock (yes = in lock, no = out of lock)
WT:	Time between phase measurements (indicates how tight the PLL is locked)
FSYNC:	C-NET frame synchronization (yes = in sync, no = out of sync)
ANA-S/N:	Displays the signal-to-noise of C-NET signal on the Receive audio input
ANA-LVL:	Displays the input level of the signal on the Receive audio input
BER:	Displays the C-NET data stream bit error rate

NIU Software Commands (continued)

SHOW – Display Information (continued)

*The **show alarm** command* displays the current and latched alarms for an CIU, NCU, and NIU. To display the alarms, type **show alarm**. The **show alarm** command for the NIU displays the following:

DEVICE 0 : 20 char string **TIME/DATE 00:34:48 01–01–1988**

##	name	latch	curr	##	name	latch	curr
00	powerfail/restart	SET	clr	16	link modem fail	clr	clr
01	20 char string	clr	clr	17	timing fail	clr	clr
02	20 char string	clr	clr	18	dial modem fail	clr	clr
03	SCM alarm (s)			19	lost cnet clock	clr	clr
04	not used in NUCLEUS			20	cnet stream	clr	clr
05	not used in NUCLEUS			21	not used in NUCLEUS	clr	clr
06	rx squelch	clr	clr	22	clan fail	clr	clr
07	ram battery	clr	clr	23	GPS comm fail	clr	clr
08	not used in NUCLEUS			24	flash cksum err	clr	clr
09	cnet lost sync	clr	clr	25	nv ram error	clr	clr
10	tx disable	clr	clr	26	not used in NUCLEUS	clr	clr
11	high BER	clr	clr	27	not used in NUCLEUS	clr	clr
12	ota maint error	clr	clr	28	frm overrun	clr	clr
13	maint reqd	clr	clr	29	not used in NUCLEUS		
14	DAC hi/low limit	clr	clr	30	DIP switches	clr	clr
15	frame align err	clr	clr	31	daily call-in	clr	clr

Refer to Table 13–2 for a complete list of all NIU alarms and their definitions.

Table 13–2. Nucleus *Internal NIU Alarms and Definitions*

Alarm No.	Alarm Name	Alarm Definition
0	Powerup/Restart	NIU has been powered up or reset
1	User-defined	User-defined
2	User-defined	User-defined
3	SCM alarm (s)	Station Control Module alarm(s)
4	Not used in *Nucleus*	
5	Not used in *Nucleus*	
6	Rx squelch	Receiver squelch
7	ram battery	RAM battery alarm
8	Not used in Nucleus	
9	C-NET lost sync	C-NET synchronization loss
10	Tx disable	Transmitter output disabled
11	High BER	C-NET bit error rate exceeded limit
12	OTA maint error	Over-the-air maintenance error
13	Maint required	Maintenance required to allow keying
14	DAC hi/low limit	Digital-analog converter high or low limit exceeded
15	Frame align error	Frame alignment error
16	Link modem fail	Link modem failure
17	Timing fail	Timing failure detected
18	Dial modem fail	Dial modem failure
19	Lost C-NET clock	C-NET clock failure
20	C-NET stream	Invalid C-NET stream
21	Not used in *Nucleus*	
22	C-LAN fail	C-LAN failure
23	GPS comm fail	GPS receiver communications failure
24	Flash cksum error	Flash checksum failure
25	NVRAM error	NVRAM error
26	Not used in *Nucleus*	
27	Not used in *Nucleus*	
28	FRM overrun	
29	Not used in *Nucleus*	
30	DIP switches	DIP switch setting and NVRAM do not match
31	Daily call-in	Daily call-in failure

NIU Software Commands (continued)

SHOW – Display Information (continued)

*The **show log** command* displays a list of the events that have occurred since the last **show log** command. The following is a typical output to the screen for the **show log** command:

DEVICE 0 : 20 char string TIME/DATE 00:34:48 01–01–1988

NUM	DEV	ID	EVENT NAME	###	TYPE	TIME	DATE	STATUS
50	NIU	8191	NIU online	38	E	12:17:31	09-16-1993	n/a
51	NIU	8191	load NIU abort	33	E	13:57:36	09-16-1993	n/a
52	NIU	8191	load NIU flash	32	E	14:04:36	09-16-1993	n/a
53	NIU	8191	powerfail/restart	0	A	14:04:36	09-16-1993	SET
54	NIU	8191	NIU offline	39	E	14:09:28	09-16-1993	n/a
55	NIU	8191	reset NIU alarms	71	E	14:09:45	09-16-1993	n/a

If there are more events in the log, but do not show on the screen, the operator will see the following message:

XX more events in log: <RET> to continue, <ESC><RET> to exit

If it is necessary to review events which occurred previous to the last **show log** command, type **show log <xix>** where xix is the number of past events to be displayed or **show log all** to display all logged events. The following is a list of the items in each column from the event log display and a brief description of each:

DEV	Display of the device type (NIU)
ID	Display of the device number of the unit where the event occurred
EVENT NAME	Display of the event or alarm name
###	Display of the event or alarm number
TYPE	Display of the log entry type, either alarm or an event
TIME	Display of the time the event or alarm occurred
DATE	Display of the date the event or alarm occurred
STATUS	Display of the state of an alarm (set or clr)

Refer to Table 13–3 for a complete list of all NIU events and their definitions.

NIU Software Commands (continued)

Table 13–3. Nucleus *Internal NIU Events and Definitions*

Event No.	Event Name	Definition and Associated Command
32	load NIU Flash	Flash memory load (load)
33	load NIU abort	Flash memory load aborted (load)
34	no NIU maint rpt	NIU did not respond to maint request
35	link load flash	Flash memory link load from CIU or NCU (linkload)
36	link load abort	Flash memory link load from CIU or NCU aborted (linkload)
37	set NIU time/date	Set NIU time and date (date)
38	new online NCU	Offline NCU switched to online (set hot_stby)
39	chng passwd	Change NIU password (config password)
40	maint cycle	Maintenance request performed (maint)
41	adj NIU sync	NIU sync adjusted (sync adjust)
42	not used	Not used
43	add zone	Zone added (config zone)
44	Rst from shell	NIU reset (reset unit)
45	change link speed	Link speed changed (set link)
46	shell rst nv	NV RAM rebooted (reset nvram)
47	not used	
48	change NIU mgroup	NIU maintenence group changed (set niu mgroup from CIU)
49	set NIU auxouts	Set NIU auxiliary to auxouts or tx freq select (set auxuse)
50	set hi ber val	Set high bit error rate threshold (set hi_ber)
51	change NIU sys id#	Change NIU system ID (config sysid)
52	set lo ber val	Set low bit error rate threshold (set lo_ber)
53	change NIU dev#	Change NIU device ID (config devid)
54	rst NIU alarms	Reset NIU alarms (reset alarm)
55	Rst from CNET	Reset over C-NET link
56	invert NIU data	
57	chng link type	Link type changed (set link)
58	non-inv NIU data	
59	scc ovr	
60	xmtr resync	(set resync)
61	link key off	Link transmitter key signal off
62	link key on	Link transmitter key signal on
63	flash erase err	Error in FLASH memory erase prior to load (load)
64	flash pgm err	Error in FLASH memory load (load)
65	change cnet stream	C-NET stream ID changed (config cnet_stream)
66	add maint group	NIU added to maintenence group (setniu mgroup from CIU)
67	del maint group	NIU deleted from maintenence group (setniu mgroup from CIU)
68	en pwr str	NIU enabled to key upon power up (setniu pwr_st from CIU)
69	dis pwr str	NIU disabled to key upon power up (setniu pwr_st from CIU)
70	chng align dist	Alignment distance changed (setniu align from CIU)
71	chng statid mode	Station ID mode changed (setniu statid _mode)
72	rst NIU log	NIU log reset (reset log)
73	rst NIU nvram	NIU NVRAM reste (reset nvram)
74	del chan	Valid channel deleted (config valid_chan)
75	add chan	Valid channel added (config valid_chan)
76	load timeout	NIU timed out before FLASH memory load completed
77	NIU adj for NMU	
78	NMU adj for NIU	
79	del zone	Zone deleted (config zones)
80	not used	
81	not used	
82	not used	
83	not used	
84	rst NIU stats	NIU status display reset (reset stats)
85	not used	
86	not used	
87	not used	
88	rst NIU log, st, alm	NIU log, status, and alarms reset (reset all)
89	not used	
90	modem init	Dial modem initiated (setniu modem from CIU)
91	not used	
92	modem ans on	Dial modem set for answer-on (setniu modem from CIU)
93	not used	
94	modem ans off	Dial modem set for answer-off (setniu modem from CIU)

NIU Software Commands (continued)

SHOW – Display Information (continued)

*The **show version** command* lists the date and time of the NV (non-volatile) RAM, FLASH, and ROM. NV RAM is a section of battery-backed RAM used to store all programmable parameters. The NV RAM date is the date the NV RAM was formatted. The other dates for FLASH and ROM are when each of the software versions were created. The dates may be different from each other.

This command can be used by typing **show version**. The NIU will respond with:

```
NVRAM:          JUN 15, 1993 9:34 AM
FLASH:          SEP 7, 1993 10:59 AM (NUC09073)
ROM:            AUG 3, 1993 12:15 PM (NUC08033)
NIU:            NUCLEUS
[   X]NUCNIU> Enter Password: _
```

*The **show config** command* is used to display all of the configuration parameters. The following is the output to the screen for the **show config** command for an NIU:

```
DEVICE NAME:        20 Characters
TIME & DATE:        HH:MM:SS  MM-DD-YY
SYSTEM ID:          4
DEVICE ID:          3
CNET STREAM:        32767
VALID ZONES:        0
TX MAINT GRP:
                    Set     Group       Chan
                    1       1           1
                    2       Not defined
VALID CHAN:         1
TX DATA POL:        norm
PWR STARTUP:        no
ALIGN DIST:         30 us
ANT OUTPUT:         tx/rx relay
ALARM 0 USE:        norm

  OTA MAINT GROUPS:
No maint grps specified
```

NIU Software Commands (continued)

SHOW – Display Information (continued)

When an NIU is configured as a Monitoring NIU, the ***show measure*** *command* displays the last measurement for all maintenance groups reporting to it. To use this command, type **show measure**. The NIU will respond with a list of the measurements:

DEVICE 0 : 20 char string **TIME/DATE 00:34:48 01–01–1988**

DEVICE ID	MAINT GROUP	REQUIRED ADJUST	AIR DELAY	MEASURE TIME&DATE
1	1	15 us	–15us	11:30:20 06:15:91
2	2	12 us	–12us	11:30:22 06:15:91
3	3	5 us	–5us	11:30:24 06:15:91
4	4	1 us	–1us	11:30:26 06:15:91

To display the last three measurements for an NIU, type **show measure <dddd>**, where dddd is the device number in the range of 0 to 8191. The NIU will respond with the following:

DEVICE ID	MAINT GROUP	REQUIRED ADJUST	AIR DELAY	MEASURE TIME&DATE
1	1	15 us	–15us	11:30:20 06:15:91
1	1	12 us	–12us	11:30:22 06:15:91
1	1	5 us	–5us	11:30:24 06:15:91

Both displays show the device number and maintenance group for each NIU reporting. The actual measurement is made from the maintenance data received from the NIUs. **REQUIRED ADJUST** is calculated by subtracting the air delay from the actual measurement.

NIU Software Commands (continued)

SHOW – Display Information (continued)

The show ota_alrms command allows access to the alarm status and log listing from a reporting NIU. This command displays the alarm status for NIUs reporting over-the-air to it. Type **show ota** and the Monitoring NIU will respond with:

display OTA log or alarms?

After you inputs the choice ("log" or "alarms"), the NIU will respond with:

OTA device (0–8191, all): for log, or
OTA device (0–8191): for alarms

An example of OTA alarm information is as follows:

DEVICE 0 : 20 char string **TIME/DATE 00:34:48 01–01–1988**
OTA ALRMS FOR DEV:1

##	name	latch	curr	##	name	latch	curr
00	powerfail/restart	clr	clr	16	link modem fail	clr	clr
01	20 char string	clr	clr	17	timing fail	clr	clr
02	20 char string	clr	clr	18	dial modem fail	clr	clr
03	not used in NUCLEUS			19	lost cnet clock	clr	clr
04	not used in NUCLEUS			20	cnet stream	clr	clr
05	not used in NUCLEUS			21	synthszr out of lock	clr	clr
06	rx squelch	clr	clr	22	low forward power	clr	clr
07	ram battery	clr	clr	23	rom cksum err	clr	clr
08	not used in NUCLEUS			24	flash cksum err	clr	clr
09	cnet lost sync	clr	clr	25	nv ram error	clr	clr
10	tx disable	clr	clr	26	high reflected power	clr	clr
11	high BER	clr	clr	27	lnk B fault	clr	clr
12	link speed error	clr	clr	28	frm overrun	clr	clr
13	maint reqd	clr	clr	29	not used in NUCLEUS		
14	DAC hi/low limit	clr	clr	30	DIP switches	clr	clr
15	tx fault	clr	clr	31	daily call–in	clr	clr

An example of OTA log information is as follows:

DEVICE 0 : 20 char string **TIME/DATE 00:34:48 01–01–1988**

NUM	DEV	ID	EVENT NAME	###	TYPE	TIME	DATE	STATUS
50	NIU	8191	NIU online	38	E	12:17:31	09-16-1993	n/a
51	NIU	8191	load NIU abort	33	E	13:57:36	09-16-1993	n/a
52	NIU	8191	load NIU flash	32	E	14:04:36	09-16-1993	n/a
53	NIU	8191	powerfail/restart	0	A	14:04:36	09-16-1993	SET
54	NIU	8191	NIU offline	39	E	14:09:28	09-16-1993	n/a
55	NIU	8191	reset NIU alarms	71	E	14:09:45	09-16-1993	n/a
56	NIU	8191	data search fault	3	A	14:31:28	09-16-1993	SET

NIU Software Commands (continued)

SHOW – Display Information (continued)

*The **show stats** command* displays statistical data for the C-NET data. This command produces the following display:

```
CNET drop outs          :0
CNET lost time          :00:00:00.
Lost data frames        :0
Peak BER                :0 E06  00:00:00  01-01-1988
Worst S/N               :57 dB  00:00:00  01-01-1988
Last stats reset        :00:00:00  01-01-1988
```

The **CNET drop outs** is a count of each time the NIU loses C-NET synchronization. The **CNET lost time** is a sum of the total time C-NET synchronization has been lost. **Lost data frames** is a count of all data frames that have been discarded due to uncorrectable control data. The **Peak BER** is the highest bit error rate received. **Worst S/N** is only applicable to analog systems. The stats values can all be reset using the **reset stats** command. When reset, the time and date is recorded and displayed as the **Last stats reset**.

*The **show analog** command* provides a display of the voltage levels for the four external and four internal alarms. Typing **show analog** produces the following output to the display:

```
DEVICE [X] : 20 character string                TIME/DATE  17:47:09  01-03-1988
unkeyed
1    20 char string:          3.1 V     2    20 char string          3.1 V
3    forward power            0.0 W     4    reflected power         0.0 W
5    Not used in NUCLEUS                6    rx squelch              0.0V
7    ram battery:             3.6 V     8    Not used in NUCLEUS
29   Not used in NUCLEUS
```

This command displays the alarm name and the voltage that is currently applied to that input.

NIU Software Commands (continued)

SHOW – Display Information (continued)

*The **show report** command* gives you the specific reporting setup for each NIU and auto adjust setup for NIUs.

```
DEVICE 0   :20 char string      TIME/DATE  14:32:27  01-26-1988
    report_phone #              :20 char phone string
    auto_rpt                    :yes or no
    alarm#'s                    :31
    events                      :yes or no
    max_trys                    :# of attempts the NIU will make
    dial_type                   :tone
    daily_call                  :what time the NIU will call each day
    ans_rings                   :1
    attempts used               :0
    items to rpt                :no

    MEASUREMENT PARAMETERS:
    adjust_phone                :20 char phone string
    min_adj_error               :30 usec
    auto_adjust                 :no
    attempts used               :0
```

See the **report** command for information on each parameter.

*The **show id** command* will cause the NIU to display a list of the current Morse Code paging station IDs for all 16 frequencies.

*The **show dipsw** command* displays the setting of DIP switch S19, which determines the link type. Enter **show dipsw** and the NIU will respond with:

```
    POS       USE          DIPSW       CURRENT
    1         dig/ana      ana         ana
    4         rf/nonrf     rf          rf
    5, 6, 7   iobd         int_nuc     int_nuc
    8         flash        INTEL       INTEL
```

These values may be overridden by using the **set link** command. However, S19 should be reconfigured as soon as possible to avoid accidental reset to the old values.

*The **show phone** command* displays the statistics for the dial-up interface.

*The **show gps** command* displays GPS receiver parameters (if there is an GPS receiver providing synchronization for the NIU).

```
DEVICE 0   :20 char string      TIME/DATE  06:13:59  02-09-1988
GMT            :   10:20;00          04-19-1994
Latitude       :   42:04:24    N
Longitude      :   179:03:17   W
Visible sats   :   6
Tracking sats  :   3
DOP            :   2.1

    SAT       SIGNAL
      1         255
      2         255
      3         255
      4         255
      5         255
      6         255
```

GMT is Greenwich Mean Time. **Visible sats** and **Tracking sats** refer to GPS satellites.

NIU Software Commands (continued)

STATID – Send NIU Programmed Station IDs

This command allows you to send the locally programmed station Morse code ID from the NIU. To send the ID, type **statid** <ENTER> and the NIU will respond with:

Are you sure!!! (y)es, if so.

Type **yes** and <ENTER> and the NIU will prompt

Channel (1–16)

Type the channel number and <ENTER> and the NIU will key the base station and send the locally programmed station ID.

SYNC – Allows NIU Synchronization Adjustments

The **sync** command allows a synchronization adjustment to be performed on an NIU. To use this command type **sync adjust <n>**, where <n> is in microseconds and in the range of 0 to 2,147,483,647

TEST – Test Mode

The **test** command helps you perform internal testing of C-NET products to assist in installation or troubleshooting. These commands should not be used while the NIU is in operation. The following is a list of the test mode commands and a brief description.

Command	Description
end	End the current test
all	Factory-test-use only
led	Test front-panel LEDs
io	Test the input and output lines
link	Test the link modem
phase	Test the phase detector circuit
da	Test the digital to analog converter
txd	Set TX keys active and send data
ota	Test over-the-air measurement data
ber	Display bit error continuously
level	Display the level continuously
forever	Run current test forever

Each command is entered with the **test** command as the first argument. The **#** is used for the prompt when the NIU is in the test mode.

TIME – Unit Time From Power Up

This is a display only command. It shows you how long a particular NIU has been operating from startup or reset. Typing **time** displays the following:

runtime = 1 days & 06:16:53.

NIU Software Commands (continued)

TRACE – Initiate Troubleshooting Trace

The **trace** command is used to facilitate troubleshooting of the NIU. To initiate a trace, type **trace <0xnn>**, where 0xnn is the argument in the trace command column of Table 13–4 below. To terminate the trace command, type **trace 0** at any time.

Table 13–4. *NIU Trace Commands*

Trace Name	Trace Cmd.	Trace Information
PLLTRACE	0x1	PLL calculations
TR_XMTR	0x2	TX data to transmit. This is done before checking the NIU for a valid C-NET stream number and verifying that the NIU is not disabled for maintenance. This will show data even if the C-NET stream is incorrect or if the NIU is disabled for maintenance. The trace will display data rate (SP), byte count (CNT), key (KY), and channel (CH). **Example: SP:1200, CNT:74,KY:1,CH:1**
TR_XMTRSND	0x4	TX data to transmit. This is done after checking the NIU for a valid C-NET stream and verifying that the NIU is not disabled for maintenance. If the C-NET stream is incorrect or the NIU is disabled for maintenance. The trace will display data rate (SP), byte count (CNT), key (KY), channel (CH), bad stream, or need sy adj.
TR_DAC	0x10	DAC adjustment information – will display information each time the D/A is adjusted. The information displayed will consist of time of day, run time in seconds, D/A value, wait time, and NIU temperature.
TR_CNETSTREAM	0x20	Displays the C-NET stream address as it is received.
TR_STATID	0x40	Morse code display of the station ID – will show alpha characters as well as Morse code dots and dashes.
CNET_CMDS	0x80	Displays the C-NET commands thát have been received which cause an action to occur – will display information only if the command was valid and no data errors occurred.
TR_MAINT	0x400	Maintenance information – displays the maintenance group and device number of OTA bursts received – will display maintenance group and device information even if the NIU is not configured for the device or if there are errors in the OTA burst.
TR_REPORT	0x1000	Report and dialing information – will show call progress for both initiating and answering calls.
TR_FRAMENUMS	0x2000	Shows alignment between NIU & NCU frame numbers.
TR_CNETADDR	0x4000	Shows address of all received C-NET addresses. If the address is not for this NIU, will display **BAD ADDR** with the received address.

NIU Software Commands (continued)

Table 13–4. *NIU Trace Commands (continued)*

Trace Name	Trace Cmd.	Trace Information
TR_XMTRINFO	0x10000	Additional information on TX data to transmit. This is done before checking the NIU for a valid C-NET stream number and verifying that the NIU is not disabled for maintenance. This will show data even if the C-NET stream is incorrect or if the NIU is disabled for maintenance. The trace will display frames (F), delay (D), parameters (P), and flags (T). **Example: F:64,D:0,P:3,T:2**
TR_XMTRSNDINFO	0x20000	Additional information on TX data to transmit. This is done before checking the NIU for a valid C-NET stream number and verifying that the NIU is not disabled for maintenance. There is no response if the C-NET stream is incorrect or if the NIU is disabled for maintenance. The trace will display frames (F), delay (D), parameters (P), and flags (T). **Example: F:64,D:0,P:3,T:2**
TR_MAINTINFO	0x40000	Shows maintenance program information, including bit errors. If the maintenance data is inverted, TOFEW will be displayed.
TR_MAINTPHASE	0x80000	Shows maintenance phase information.
TR_CNETERRS	0x100000	Shows the number of FIX and UNFIXABLE bit errors in a frame.
CNET_CMD_NUMS	0x200000	Displays C-NET command numbers received – will show command numbers even if command is not valid or not for this NIU.
UNUSEDTR26	0x400000	Displays transmit software debugging information. ***CAUTION:*** *This trace can cause a unit reset and should not be run on critical units. If it is run, it should be run only via the front panel* **Console** *connector at a data rate of 57,600 bps.*
UNUSEDTR30	0x4000000	Lost data frames information

Setup of NIU

Setup Considerations

Before configuring an NIU, you must determine the following:

- What is the name of the site where this NIU will be located?
- What system number should be used?
- What device number should be used?
- What frequency/channels should this NIU key on?
- What maintenance group number should this NIU belong to?
- What zones should be set up?
- Does the transmit data need to be inverted?
- Does this transmitter overlap with others (simulcast)?

The **config** command allows you to set up the specific parameters which uniquely identify each NIU. The **show config** command is used to display all of the config parameters. The following is the output to the screen for the **show config** command for the NIU:

```
DEVICE NAME:        Lab Test
TIME & DATE:        19:15:23  01-01-1988
SYSTEM ID:          2
DEVICE ID:          1
VALID ZONES:        0
TX MAINT GRP:       Set       Group      Chan
                    1         0          1
                    2         Not defined
VALID TX CHAN:      1 2
TX DATA POL:        norm
PWR STARTUP:        yes
ALIGN DIST          100 uS
ANT OUTPUT:         tx/rx relay
ALARM 1 USE:        norm

OTA MAINT GROUPS:
GROUP    DEVICE    AIR DELAY    LOG OTA
  0        1000       0 uS        yes
  1         101       135 uS      no
```

The above list shows the "CONFIG" parameters that need to be setup, and also shows the settings from the factory. To configure the NIU, type: **config** <ENTER> at the ">" prompt and the screen will display:

```
config what (devid|sysid|name|tx_maint|ota_maint|password|key_alarm|
    nmu_key|zones|id|valid_chan|txd|pwr_strt| align|cnet_stream)
```

Setup of NIU (continued)

Name

The first config parameter that should be set is the station name. The name is usually the name of the site where the base station is located. To set the name, type **config name** <ENTER> and the NIU will respond with:

>name = 20 char string
>Enter new name: _

Enter the name, up to 20 characters, that you wish to assign to this NIU, and strike <ENTER>. The NIU will verify the name that was set by displaying:

name = <20 char name

System ID

The next config parameter that must be set is the system ID. The system ID is factory set to 1. To set the system id, type **config sysid <system ID>** <ENTER>, where <system ID> is a number in the range of 1 to 255.

Device ID

Next the device ID should be set. To set the device ID, type **config devid <device ID>** <ENTER>, where <device ID> is a number in the range of 0 to 8191. Device IDs in a system usually start with 1 and increment up to the last transmitter in the system.

Valid Channels

The valid channels must now be configured. To set the channel map, type **config valid_chan**. The NIU will respond with:

valid_chan what (add|delete|list)

If **add** or **delete** is chosen, the NIU will prompt for the channel number to add or delete. The **list** argument may be used to display the current valid channels.

Maintenance Group

The maintenance groups to which this NIU belongs must be set. To set the maintenance group, type **config tx_maint** <ENTER>. The NIU will prompt for the maintenance set, group, and maintenance channel number to be used.

Zone Selection

If zoning is used in the system, the zone parameter must be set. To set the zone parameter, type **config zones** <ENTER>. The NIU will prompt:

zones what (add|delete|list)

If **add** or **delete** is selected, the NIU will prompt for a zone number between 0 and 31 to be added or deleted. The **list** argument may be used to display the current zones.

Setup of NIU (continued)

Transmit Data

The transmit data output to the base station can be inverted, if necessary. However, if all base stations in the system require the data to be inverted then the data inversion jumper on the NCU should be used for this function. To set the data invert parameter, type the command **config tx_d** <ENTER>. The NIU will prompt for normal or inverted data.

Power Startup Parameter

The power startup parameter should be set. This parameter permits the NIU to be set for immediate keying on power-up, or to wait for a sync adjust command before keying. When simulcasting, the NIU should be set to wait for sync, and when used in non-simulcast applications it should be set for immediate keying. Use the command **config pwr_strt** <ENTER> and then enter **yes** at the **Startup parm (no, yes)** prompt to set for key immediate on power-up and or enter **no** to set for key after receiving sync adjust command on power-up.

Alignment Distance

The alignment distance is set for 30 microseconds from the factory. This setting is normally appropriate and does not need to be changed. This parameter allows you to program the maximum delay change (sync adjustments from the NCU) that can be made without unkeying and losing data. Sync adjustments received from the NCU which are less than alignment distance will be delayed until paging traffic ceases. Sync adjustments larger then the alignment distance will become effective immediately and will result in a temporary base station unkey and possible loss of data. To set the alignment distance, use the command **config align** and enter the maximum air delay change in microseconds.

Additional Parameters

Additional NIU parameters for alarms and reporting can be set up at this time. Additional parameters would be determined by the specific installation and site requirements.

Operation and Checkout of NIU

NOTE: The **KEY** *LED indicator is located behind the front panel and is not visible during normal operation with the front panel in place.*

Paging Station Deviation Check

Refer to the appropriate *Nucleus* paging station manual for deviation adjustment procedures. After applying power to the station, verify that the following LED conditions exist on the NIU:

LED	Condition
STATUS	Orange Flashing
KEY	Orange (depends on config pwr_strt parameter setting)
C-NET	Orange (if C-NET is present, the LED will turn green shortly after power-up; if C-NET is not present, the LED will turn red after approximately 60 seconds)

If the **KEY** LED is orange, the NIU is awaiting a sync adjustment from the CIU. The NIU will require a sync adjustment command before the base station will key. Type the command **sync adj** <ENTER>. The **KEY** LED should turn off. This will allow the NIU to be tested.

Link Receiver Input Level Check

If the link system is analog, check the link receiver input level. The level can be set with either a single 1000 Hz tone or with C-NET present on the RX audio input. To display the input level from the user interface, type the command **test level** and <ENTER>. The NIU will display the signal-to-noise ratio and the input level. If the receive input level is not set to −10 dBm, use the **set level** command to make this adjustment. The signal-to-noise level can also be checked while running the test level command; however, C-NET must be present on the receive audio input. The minimum operational signal-to-noise level is 23 dB; however, this does not allow for any margin. It is recommended that a minimum 25 dB signal-to-noise be achieved. After the level has been set and C-NET applied to the receive input, the C-NET LED should be solid green.

After the installation and power-up, the NIU will have alarms that must be cleared/reset. To clear these, type **reset all** <ENTER>. The NIU will respond with:

are you sure!!! (y)es, if so. _

Type **y** and the alarms, log and stats will all be reset.

Operation and Checkout of NIU (continued)

NIU Statistics

To check the link performance, periodically check the NIU's statistics. The **show stats** command is used to display the statistical information for the C-NET data. This command produces the following display:

CNET drop outs	**:0**
CNET lost time	**:00:00:00.**
Lost data frames	**:0**
Peak BER	**:0 E06 00:00:00 01-01-1988**
Worst S/N	**:57 dB 00:00:00 01-01-1988**
Last stats reset	**:00:00:00 01-01-1988**

Base Station Deviation

***NOTE**: This step is a check only. Individual positive and negative deviations cannot be set separately.*

The *Nucleus* paging station deviation should now be checked and adjusted. Refer to the appropriate *Nucleus* paging station manual for adjustment procedures. The following test should be done three times, once with the data set to all "1s" to set the negative deviation, once with the data set to all "0s" to set positive deviation. As a final operational check, an alternating 1/0 pattern should be used to simulate actual data transmission. Each time the deviation should be checked with a service monitor. To run the test, enter the command **test txd** <ENTER>. The NIU will respond with:

bps rate: _

Enter the data rate desired (e.g.: 1200 or 2400) and the NIU will prompt with:

tx baud rate: _

The tx baud rate sets the TXBCLK output rate. The possible inputs include, 1, 2 or 4. The TXBCLK output is not used. Type **1** and <ENTER> and the NIU will respond with:

tx data encoding: _

The NIU is now prompting for the data encoding mode. The input can be either NRZ (non-return to zero) or NRZI (non-return to zero inverted, transitions for zero only). Type **nrz** and <ENTER>. The NIU will respond with:

tx data polarity: _

Enter the data polarity (**norm** or **invert**). If **invert** is selected, the data to the base station will be inverted; if **norm** is selected, the data will be sent without the inversion. Next the NIU will prompt for the transmit data type:

tx data : _

The transmit data is an 8-bit hexadecimal value that is transmitted repeatedly until the test is ended. To check the positive deviation, type in **0xff**; to check the negative deviation type in **0**; and to check the deviation with a alternating 1/0 pattern, type **0x55**. After the transmit data is entered the NIU will respond with:

tx channel :

Operation and Checkout of NIU (continued)

Base Station Deviation (continued)

Enter the desired channel number (**1** to **4**). After the channel number is entered, the NIU will key the base station and send the transmit data that was selected. The NIU also will change the prompt from > to # and display the following:

BPS:1200, baud:1, encode:nrz
TXD:norm, pat:55, chan:1
[x] NUCNIU # running txd test

To start the test over with new parameters, type the command in again and step through the above procedure. To end the test, type **test end** <ENTER>. The NIU will end the test, return to the ">" prompt, and display the following:

txd test ended

Alarms

Clear the alarms and check that all alarm conditions have cleared. To clear the alarms, type **reset alarm** <ENTER>. If all the alarms have cleared, the front panel ALARM LED will be green. If the LED did not turn green, type **show alarm** <ENTER> to display the alarms and their status. The NIU will display the following:

DEVICE 0 : 20 char string **TIME/DATE 00:34:48 01-01-1988**

##	name	latch	curr	##	name	latch	curr
00	powerfail/restart	clr	clr	16	link modem fail	clr	clr
01	20 char string	clr	clr	17	timing fail	clr	clr
02	20 char string	clr	clr	18	dial modem fail	clr	clr
03	not used in NUCLEUS			19	lost cnet clock	clr	clr
04	not used in NUCLEUS			20	cnet stream	clr	clr
05	not used in NUCLEUS			21	synthszr out of lock	clr	clr
06	rx squelch	clr	clr	22	low forward power	clr	clr
07	ram battery	clr	clr	23	rom cksum err	clr	clr
08	not used in NUCLEUS			24	flash cksum err	clr	clr
09	cnet lost sync	clr	clr	25	nv ram error	clr	clr
10	tx disable	clr	clr	26	high reflected power	clr	clr
11	high BER	clr	clr	27	lnk B fault	clr	clr
12	link speed error	clr	clr	28	frm overrun	clr	clr
13	maint reqd	clr	clr	29	not used in NUCLEUS		
14	DAC hi/low limit	clr	clr	30	DIP switches	clr	clr
15	tx fault	clr	clr	31	daily call-in	clr	clr

The display will show "SET" in the "curr" (current) column if an alarm condition exists. You should determine why the alarm exists and remedy the condition so the alarm can be cleared.

OTA Data Measurement

The last item to be checked is the OTA (over-the-air) data measurement. An operational Monitoring NIU with this NIU's maintenance group programmed and a monitor receiver able to receive this NIU must be available for this test. To test the OTA data measurement, use the **test ota** command. The NIU will respond with:

Time (in seconds) between ota commands: _

Type **5** and <ENTER>, causing the NIU to send out maintenance data every five seconds. You must connect to the Monitoring NIU and display the maintenance measurement data. This can be done by using the **show measure** command in the Monitoring NIU.

Setup of Monitoring NIU

Setup Considerations

Before configuring the Internal NIU as a Monitoring NIU, you must determine the following:

- What is the name of the site where this NIU will be located?
- What system number should be used?
- What device number should be used?
- What maintenance groups will be reporting to this Monitoring NIU?
- What are the air time delays for each transmitter reporting?
- What is the phone number for the CIU?

The **config** command allows you to set up the specific parameters which uniquely identify each NIU. The **show config** command is used to display all of the config parameters. The following is the output to the screen for the **show config** command for the NIU:

```
DEVICE NAME:        20 character string
TIME & DATE:        19:15:23  01-01-1988
SYSTEM ID:          2
DEVICE ID:          1
VALID ZONES:        0
TX MAINT GRP:       Set       Group       Chan
                    1         0           1
                    2         Not defined
VALID TX CHAN:      1 2
TX DATA POL:        norm
PWR STARTUP:        yes
ALIGN DIST          100 uS
ANT OUTPUT:         tx/rx relay
ALARM 1 USE:        norm
LOG OTA ALARM:      yes

OTA MAINT GROUPS:
GROUP   DEVICE   AIR DELAY   LOG OTA
  3      2468      358 uS      yes
  4      3579      572 uS      no
  5      964       690 uS      yes
```

The above list shows the "CONFIG" parameters that need to be set up, and also shows the settings from the factory. To configure the NIU, type: **config** <ENTER> at the ">" prompt and the screen will display:

```
config what (devid|sysid|name|tx_maint|ota_maint|password|key_alarm|
    nmu_key|zones|id|valid_chan|txd|pwr_strt|align|cnet_stream)
```

Setup of Monitoring NIU (continued)

Name

The first config parameter that should be set is the station name. The name is usually the name of the site where the station is located, To set the name, type **config name** <ENTER> and the NIU will respond with:

name = 20 char string
Enter new name: _

Enter the name for this NIU (up to 20 characters), and press <ENTER>. The NIU will verify the name that was set by displaying:

name = 20 Character name

System ID

The next config parameter that must be set is the system ID. The system ID is factory set to 1. To set the system id, type **config sysid <system ID>** <ENTER>, where <system ID> is a number in the range of 1 to 255.

Device ID

Next the device ID should be set. To set the device ID, type **config devid <device ID>** <ENTER>, where <device ID> is a number in the range of 0 to 8191. Device IDs for Monitoring NIUs in a system usually start with an even number above the largest NIU device ID and increment up to the last NIU.

Maintenance Groups and Air Delay Time

All maintenance groups that will be reporting to this Monitoring NIU should be programmed. The Monitoring NIU will perform maintenance measurements on and receive log and alarm data from NIUs that are programmed into its maintenance group list. To set the maintenance group(s) for a monitor site, type the command **config tx_maint** <ENTER>. The NIU will prompt for the maintenance group and maintenance channel number to be used.

The NIU may be configured to monitor over-the-air alarms for logging or dial-up phone line reporting to the NCU by the **config ota_maint** command. The logged alarms may be displayed by the **show ota_alrms** command. To configure the over-the-air alarms, type **config ota_maint** <ENTER>, and the NIU will prompt for the maintenance group and device number to be used.

After the Monitoring NIU maintenance group and device number are entered, the NIU will prompt for the air delay time:

Air delay in uS (0–50000):

The air delay time for each maintenance group reporting to the Monitoring NIU must be programmed. The air delay is the propagation delay of the rf signal from a paging transmitter site to the receive monitor site. This is the only variable in the measurement process that is different from site to site. The air delay parameter must be manually calculated for each site. Contact your Motorola GPCS applications engineer for assistance in calculating the appropriate air delay times for your particular system.

Setup of Monitoring NIU (continued)

OTA Alarm Reporting

After the air delay is entered, the NIU will respond:

Log OTA items (n/y):

Type **no** if the reporting NIU's measurement parameters automatic report function is enabled; otherwise type **yes**.

Next, the measurement and reporting parameters must be set. To display these parameters, type **report** <ENTER> and the NIU will respond with:

```
DEVICE 0      : 20 char string          TIME/DATE  09:51:33  07-21-1993
rept_phone#                    :20 char string
auto_rpt                       :no
alarm#'s                       :31
events                         :no
max_trys                       :10
dial_type                      :tone
daily_call                     :08:00:00
ans_rings                      :1
attempts used                  :0
items to rpt                   :no

MEASUREMENT PARAMETERS
adj_phone                      :20 char string
min_adj_error                  :30 uSec
auto_adj                       :no
attempts used                  :0

     editwhat (rept_phone#|auto_rpt|alarm#'s|events|max_trys|dial_type|daily_call|
     ans_rings|adj_phone|min_adj_error|auto_adj)
```

The bottom line of the display lists all of the possible report commands that can be used. The NIU is now ready for input of the report commands. The following paragraphs describe in detail each of the report commands. Each of these commands must be entered from the report setup prompt.

Setup of Monitoring NIU (continued)

OTA Alarm Reporting (continued)

The **report_phone#** is a 20-character string that is used in conjunction with the Hayes "ATD" command, to dial the console for alarm reporting. This is the phone number that is used for alarm reporting. To change the report phone number, type **report_phone#**. The NIU will respond with:

enter new report_phone# (or erase):

Enter up to a 20-character phone number or type **erase** to clear the number. A sequence of Hayes command dial modifiers may also be placed in the phone number.

The **auto_rpt** command allows you to enable or disable the automatic alarm reporting function.

auto dial reporting (y)es or (n)o:

Type **y** to enable the alarm reporting function or **n** to disable it.

The **alarm#'s** is a list of alarms that cause the NIU to dial out and report when any one or more of them become valid. To add or delete alarm numbers in the list, type **alarm#'s**. The NIU will respond with:

alarm initiating call-in?
31
add or delete?

Enter **add** or **delete** at the above prompt and the NIU will respond with:

enter alarm #'s (up to 10 at a time):

Enter all alarms that are to initiate a dial out with a space between each. If more than ten are required, enter the first group of numbers and then type the **alarm#'s** command again.

The **events** command allows you to send the event log with the alarms when doing a report. To enable or disable this feature, type **events**. The NIU will respond with:

report events with alarm (y)es or (n)o?

Type **y** or **n** at the above prompt.

The **max_trys** is the number of attempts (per hour) that the NIU will make at calling the console to report alarms. When the **max_trys** limit is reached the NIU will stop dialing out and set alarm number 18 (dial modem fail). The **max_trys** limits the phone line usage if a wrong number is programmed or some other malfunction occurs. To set the maximum number of tries, type **max_trys**. The NIU will respond with:

enter max_trys:

Enter max_trys from 1 to 20. The number of attempts used can be reset with the **reset call_attempts** command.

Setup of Monitoring NIU (continued)

OTA Alarm Reporting (continued)

The internal dial modem can dial with either pulse or tone method. This is set with the **dial_type** command. To set the dial type, type **dial_type** and the NIU will respond with:

enter dial_type:

Enter **tone** or **pulse** at the above prompt.

The **daily_call** command sets the time when alarm number 31 (daily call-in) occurs. To set the daily call time, type **daily_call** and the NIU will respond with:

enter daily_call (hh:mm OR none):

Enter the time with a colon (:) between each hour, minute and the second or to disable, type **none**.

IMPORTANT

The **adj_phone** parameter must be set for a Monitoring NIU.

The **adj_phone** command is a 20-character string that is used, in conjunction with the Hayes "ATD" command, to dial the console for alarm reporting. This is the phone number that is used for maintenance reporting and should be set to the phone number for the CIU. To change the adjust phone number, type **adj_phone**. The NIU will respond with:

enter new adjust_phone (or erase): _

Enter up to a 20-character phone number or type **erase** to clear the number. A sequence of Hayes command dial modifiers may also be placed in the phone number.

The **min_adj_error** is the allowable tolerances in system timing synchronization (for example, only adjust for differences greater than 30 microseconds from ideal). To set type **min_adj_error** and the NIU will respond with:

enter new min_adj_error: _

The **auto_adjust** command allows you to enable or disable the maintenance reporting function. To set type **auto_adjust** and the NIU will respond with:

auto adj (y/n)

Type **y** to enable the maintenance reporting function or **n** to disable it.

14 STATION ALIGNMENT

This section contains procedures for optimizing and aligning the *Nucleus* Paging Station using the station Control Front-Panel keypad. ***The station should not require realignment unless the Exciter Module/Station Control Board pair or the Power Amplifier Module is replaced.***

Station Power Output Alignment

CAUTION

Serious damage to the Power Amplifier Module can result if the following precautions are not followed. Damage to the Nucleus station due to improper use will not be covered under the warranty.

The coupler, attenuator, load, and power meter used to measure station output power must be connected ***directly*** to the PA Power Output Alignment Point, which is the N-type connector at the end of the station transmit output cable from the Power Amplifier Module at the rear of the station. Be sure to use proper connectors, with no adapters or intermediate cables between the PA Power Output Alignment Point and the wattmeter.

External Circulator (Option X676 or Option X677):
If there is a circulator assembly attached to the rear of the station, you must detach the station transmit output cable from the input to the circulator assembly, and then connect the end of the cable (the PA Power Output Alignment Point) directly to the coupler, attenuator, load, and power meter. ***Do not*** attempt to compensate for losses beyond the PA Power Output Alignment Point.

Test Equipment Required

The following test equipment is recommended for performance of the Station Power Output Alignment and External Wattmeter Calibration.

- RF Coupler, Attenuator, and Load

  Coupler and attenuator must be calibrated before beginning procedure. Load must have greater than 30 dB return loss.
- RF Power Meter *(for example, an HP 438A Power Meter)*

  Power meter accuracy must be 3.5% or better

All items must be capable of handling maximum station output power.

Test Equipment Setup

For station alignment, connect the test equipment to the Paging Station as shown in Figure 14–1.

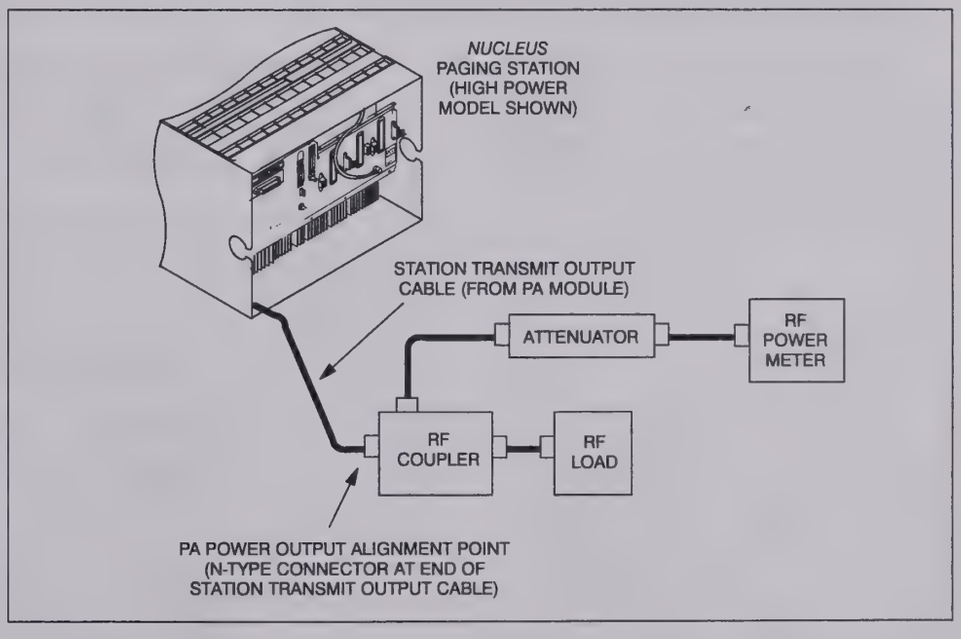


Figure 14–1. *Test Equipment Setup for Station Power Output Alignment Procedure*

Station Power Output Alignment (continued)

IMPORTANT

The station must be allowed to warm up for a minimum of one hour prior to beginning these procedures. The procedures must be performed in the indicated order to properly align the station.

CAUTION

The mean frequency may ***not*** be an approved transmit frequency. During this procedure, be sure to connect the station transmit output to a dummy load and ***not*** into the transmit antenna. Ensure that the power measurement equipment is calibrated to operate at the mean frequency.

IMPORTANT

Before performing the Station Power Output Alignment procedure, be sure the **EXT CIRCULATOR** item on the **STATION OPTIONS 1** menu is set to **NOT PRESENT**.

Station Power Output Alignment Procedure

Power output is aligned to a high degree of accuracy in the factory. ***Field alignment is only necessary if the Exciter Module/Station Control Board pair or the Power Amplifier Module is replaced.***

The following procedure calibrates the actual rf power output level of the station (measured at the PA Power Output Alignment Point) to the programmed value.

Step 1. Press any front panel key to enable the entry of data. If necessary, enter the proper password, followed by **ENT**. The front panel display should show **READY.**

Step 2. From the front panel **READY** prompt, enter the Transmit menu by pressing the **TX** key. The display shows **TX CHN FREQS**.

Step 3. Press the **ENT** key. The display shows **CHN 1 FREQ xxx.xxxx MHz,** where xxx.xxxx is the selected channel frequency. Press the up arrow (▲) key once. The display shows **MEAN FREQ xxx.xxxx MHz**. This is the midpoint between the highest and lowest transmit channel frequencies. The station will key on this frequency in Step 12. (See **CAUTION** at left.)

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Step 5. Press the **CNFG** key to enter the Station Configuration menu. The display shows **MAX PWR xxx W,** where xxx is the rated power of the PA.

Step 6. Press the **EXIT** key to return to the **READY** prompt.

The following steps (Step 7 through Step 10) depend on whether the channel-mapped power feature is to be disabled or enabled. Go to Step 7 if you do not want to enable channel-mapped power. Go to Step 9 to enable and use channel-mapped power.

Step 7. ***Enter the desired station power as follows. (Use this step if channel-mapped power is disabled and will not be enabled. Skip this step and go to Step 9 to enable and use channel-mapped power.)***

Enter the Transmit menu by pressing the **TX** key. The display shows **TX CHN FREQS**.

Press the ▼ key until **TX CHN PWR** is displayed.

Press the **ENT** key. The display shows **OPERATING PWR xxx W,** where xxx is the currently programmed station transmit power.

To change the station power, press the **ENT** key. The station power value flashes.

Enter the desired station power value in watts, using the front panel digit keys. Then press the **ENT** key. The display shows **OPERATING PWR yyy W,** where yyy is the newly entered station power value.

Step 8. Press the **EXIT** key twice to return to the **READY** prompt.

Station Power Output Alignment (continued)

Step 9. ***Enable channel-mapped power and enter the mean frequency power level as follows. (Skip this step and go to Step 11 if you do not want to enable the channel-mapped power feature.)***

From the **READY** prompt, press the **OPT1** key to enter the Station Options 1 menu. Press the ▼ key until **CHN MAPPED PWR: DISABLED** is displayed.

Press the **ENT** key. The display shows **DISABLED** (flashing).

Press the **TOG** key to change the setting, followed by **ENT.** The display shows **CHN MAPPED PWR: ENABLED**.

Press the **EXIT** key to return to the **READY** prompt.

Press the **TX** key to enter the Transmit menu. Press the ▼ key until **TX CHN PWR** is displayed.

Press the **ENT** key. The display shows **CHN n PWR xxx W,** where xxx is the currently programmed transmit power for channel n.

Press the ▼ key until the display shows **MEAN FREQ PWR zzz W,** where zzz is the currently programmed power level for the mean frequency.

To change the mean frequency power level, press the **ENT** key. The power value flashes.

Enter the desired power level value in watts, using the front panel digit keys. Then press the **ENT** key. The display shows **MEAN FREQ PWR yyy W,** where yyy is the newly entered power value.

Step 10. Press the **EXIT** key twice to return to the **READY** prompt.

Station Power Output Alignment (continued)

IMPORTANT

Use only the **INITIALIZE CALIBRATION** item on the **ALIGN \ CAL STATION POWER** menu. Do not use the **CALIBRATE** menu item, which is for factory use only and ***should not be used in the field***.

IMPORTANT

This alignment procedure prevents large changes in output power to prevent PA cutbacks. If the actual measured output power on the wattmeter is significantly less than the programmed power level, do not enter the actual power level in the **INPUT MEASURED PWR** field. Instead, enter a value which is approximately 20% less than the programmed value. Repeat this until the actual measured power level is within 20% of the programmed value. At this point, the measured value may be entered.

For example: if the programmed value is 50 watts and the actual measured value is 15 watts, enter "40" repeatedly until the actual measured value is greater than 40 watts. Then begin entering the actual measured value (50) until the wattmeter indicates 50 watts.

NOTE: *If station power output is degraded by more than 5% of the rated power output, the station will automatically exit the Station Alignment menu, the yellow* **PA Low** *LED will light momentarily, and the station will dekey.*

Step 11. Enter the Station Alignment menu by pressing the **ALGN** key. The display shows **CAL STATION POWER**.

Step 12. Press the **ENT** key. The station keys and the Exciter **PA Full** LED lights. Using the power meter, coupler, attenuator, and load as shown in Figure 14–1, observe the power meter output for an indication of output power. The display shows **INITIALIZE CALIBRATION**.

Step 13. Press the **ENT** key once. The display shows **INPUT MEASURED PWR**.

Step 14. Be sure to read the **IMPORTANT** notice at left. Read the power level on the power meter and enter the indicated value in watts, using the keypad digit and **ENT** keys.

Step 15. Repeat Step 14 until the measured power displayed on the power meter matches the **OPERATING PWR** value entered in Step 7.

Step 16. Leave the Station Alignment menu by pressing the **EXIT** key three times. The display returns to the **READY** prompt and the station dekeys (power meter level goes to zero).

(When you press the **EXIT** key the first time, the station automatically calibrates the internal wattmeter and sets the overdrive set point. The display shows **INT WM CAL** and then **SET OVER**.)

Step 17. Detach the power meter setup from the PA Power Output Alignment Point (refer to Figure 14–1). Reattach the PA Power Output Alignment Point to the transmit antenna cable, External Circulator assembly, or Antenna Relay module (depending on station options).

Station Power Output Alignment (continued)

External Wattmeter Calibration (for station with Double or Triple Circulator option only)

If the station has a Double Circulator (Option X677) or a Triple Circulator (Option X676), the circulator assembly includes an External Wattmeter, which is attached to the peripheral bracket on the rear of the station. The External Wattmeter is factory-calibrated and should not be recalibrated unless the Exciter Module/Station Control Module pair or the Power Amplifier Module is replaced. ***Perform the Station Power Output Alignment procedure before performing the External Wattmeter Calibration.***

Step 1. At the rear of the station, lift the peripheral bracket out. Detach the transmit antenna cable from the rf output port on the peripheral bracket, and attach the power meter (with coupler, attenuator, and load) to the rf output port.

Step 2. Enter the Station Alignment menu by pressing the **ALGN** key. The display shows **CAL STATION POWER**. Press the ▼ key until **CAL EXT WM** is displayed.

Step 3. Press the **ENT** key. The station keys and the Exciter **PA Full** LED lights. The display shows **INPUT MEASURED PWR**.

Step 4. Read the power level on the power meter and enter the indicated value in watts, using the keypad digit and **ENT** keys.

Step 5. Leave the Station Alignment menu by pressing the **EXIT** key three times. The display returns to the **READY** prompt and the station dekeys (power meter level goes to zero).

Step 6. Detach the power meter setup from the rf output port on the peripheral bracket, and reattach the transmit antenna cable to the rf output port.

UHSO/HSO Alignment
(for station with Reference Module with UHSO or HSO only)

If the *Nucleus* station was ordered with an Option X206 Reference Module with UHSO, or Option X208 Reference Module with HSO, the UHSO or HSO was aligned to a high degree of accuracy in the factory. ***Field alignment is only necessary for periodic maintenance (as described in Section 17) or if the Exciter Module/SCB pair has been replaced.***

UHSO/HSO Alignment allows you to adjust frequency to within 1 Hz. The procedure can be done in two ways:

- In a *non-keyed state,* on the 5 MHz reference frequency
- In a *keyed state,* on the station mean frequency

Non-keyed-state alignment does not interrupt paging operations. ***Keyed-state alignment does interrupt paging operations.***

Test Equipment Required

The following test equipment is recommended for performance of the UHSO/HSO Alignment.

- Frequency Counter (for example, Motorola R2000 Series Communications Analyzer with external rubidium standard) with following accuracy:

  UHSO: ≤ 0.5 ppb
  HSO: ≤ 3 ppb

- RF Coupler, Attenuator, and Load (for keyed-state alignment only)

UHSO/HSO Alignment (continued)

Non-keyed-state Alignment (Reference Frequency)

Test Equipment Setup

For non-keyed-state alignment, connect the test equipment to the station as shown in Figure 14–2.

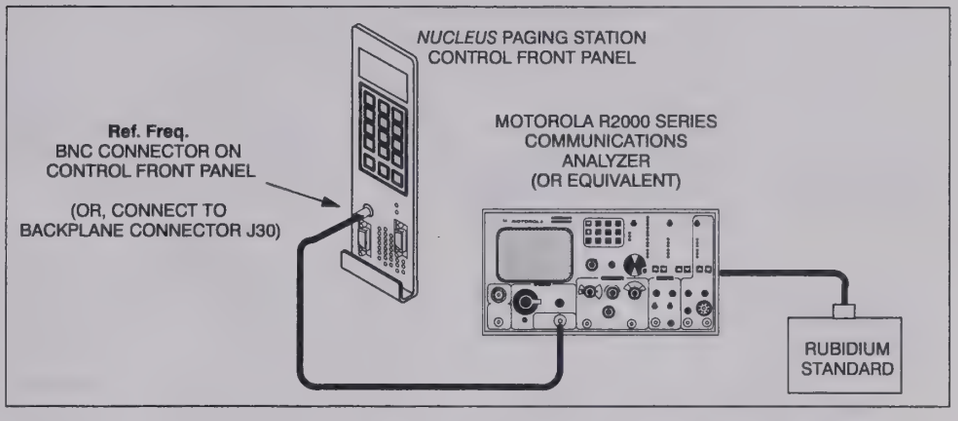


Figure 14–2. *Test Equipment Setup for Non-keyed-state Alignment*

IMPORTANT

If the station has an Internal NIU *and* a Reference Module with a UHSO or HSO, DIP switch S8 on the Internal NIU must be set correctly:

When using a Reference Module with a UHSO/HSO as the station frequency reference, S8, pole 1 must be set to **ON**.

When using the Internal NIU as the station frequency reference, S8, pole 1 must be set to **OFF**.

In all cases, S8, pole 2 must be set to **ON**.

(See Section 13 – *Internal NIU Configuration* for DIP switch location.)

Alignment Procedure:

Step 1. From the **READY** prompt, press the **ALGN** key to enter the Station Alignment menu. Press the ▼ key until the display shows **ALIGN UHSO**.

Step 2. Press the **ENT** key once. The display shows **KEY START**.

Step 3. Press the ▼ key once. The display shows **START**. Press the **ENT** key once. The *station does not key* and the display shows **UHSO xxxx**, where xxxx is the steering line voltage (greater than 0 and less than 4096).

Step 4. While monitoring the reference frequency, enter a new steering line value via the keypad digit keys (four digits, followed by **ENT**).

Step 5. Repeat Step 4 as many times as necessary to bring the monitored frequency within specifications.

Step 6. Exit the Station Alignment menu by pressing the **ENT** key twice. The display shows **READY**.

UHSO/HSO Alignment (continued)

CAUTION

The mean frequency may ***not*** be an approved transmit frequency. If you key on mean frequency in this procedure, be sure to connect the station transmit output to a dummy load and ***not*** into the transmit antenna.

IMPORTANT

If the station has an Internal NIU *and* a Reference Module with a UHSO or HSO, DIP switch S8 on the Internal NIU must be set correctly:

When using a Reference Module with a UHSO/HSO as the station frequency reference, S8, pole 1 must be set to **ON**.

When using the Internal NIU as the station frequency reference, S8, pole 1 must be set to **OFF**.

In all cases, S8, pole 2 must be set to **ON**.

(See Section 13 – *Internal NIU Configuration* for DIP switch location.)

Keyed-state Alignment (Mean Frequency)

Test Equipment Setup

For keyed-state alignment, connect the test equipment to the station as shown in Figure 14–3. See **CAUTION** at left.

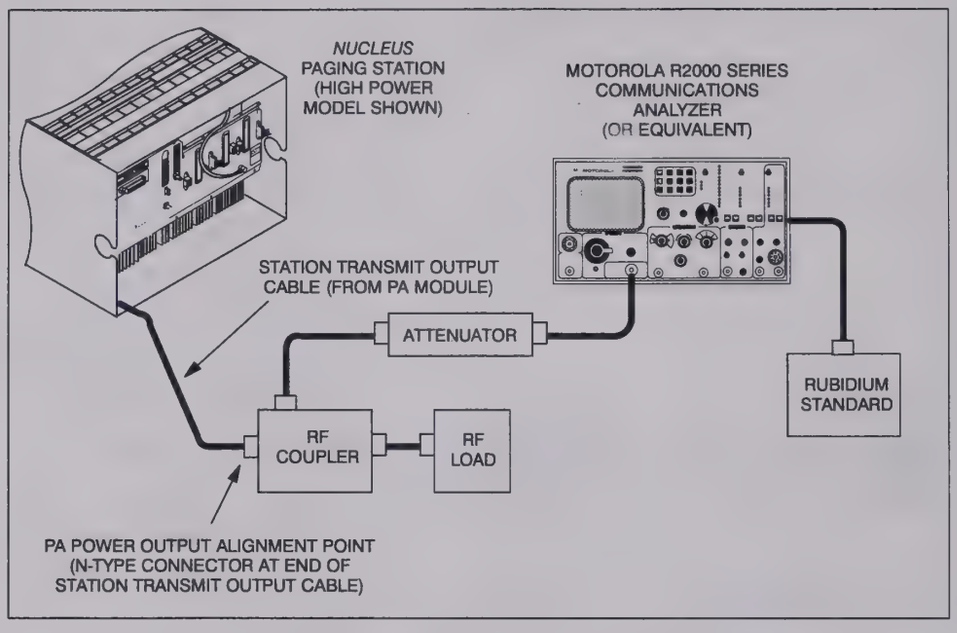


Figure 14–3. *Test Equipment Setup for Keyed-state Alignment*

Alignment Procedure

Step 1. From the **READY** prompt, press the **ALGN** key to enter the Station Alignment menu. Press the ▼ key until the display shows **ALIGN UHSO**.

Step 2. Press the **ENT** key once. The display shows **KEY START**.

Step 3. Press the **ENT** key once. The *station keys* and the display shows **UHSO xxxx**, where xxxx is the steering line voltage (greater than 0 and less than 4096).

Step 4. While monitoring the mean frequency, enter a new steering line value via the keypad digit keys (four digits, followed by **ENT**).

Step 5. Repeat Step 4 as many times as necessary to bring the monitored frequency within specifications.

Step 6. Exit the Station Alignment menu by pressing the **ENT** key twice. The display shows **READY**.

Alignment Completion

When all other alignment procedures have been completed, use the following procedure to check forward power, reflected power, and VSWR.

Step 1. From the **READY** prompt, press the **ALGN** key to enter the Station Alignment menu. Press the up arrow (▲) key once.

The display shows **KEY AND READ POWER** if the **EXT WATTMETER TYPE** parameter on the Station Configuration menu is set to **NONE**. Go to Step 2 (and ignore Step 3).

The display shows **KEY AND READ EXT WM POWER** if the **EXT WATTMETER TYPE** parameter on the Station Configuration menu is set to **EXT CLASS 1** (or **2**, **3**, or **4**). Go to Step 3.

Step 2. Press the **ENT** key once. This function (**KEY AND READ POWER**) allows the user to key the station with a silent carrier and display output power. The display scrolls the values for Forward Power, Reflected Power, and VSWR. This function may be used to adjust or verify the forward power adjustment.

Step 3. Press the **ENT** key once. This function (**KEY AND READ EXT WM POWER**) allows the user to key the station with a silent carrier and display external wattmeter output power (if an external wattmeter is installed). The display scrolls the values for External Wattmeter Forward Power, Reflected Power, and VSWR. This function may be used to adjust or verify the forward power adjustment.

15 ALARMS

Reading and Clearing Alarms

Press the **ALMS** key to display station alarms. If there are no alarms active, the display will show **NO ALARMS**. If there are active alarms, the first alarm message will be displayed. Press the ▲ or ▼ key to scroll through any other active alarms.

To clear an alarm, press the ▲ or ▼ key until the alarm is displayed. Press the **ENT** key once. The display shows **ACTIVE**. Press the **TOG** key so that the display shows **INACTIVE**. Press the **ENT** key to clear the alarm. Repeat as required to clear any other active alarms, then press **EXIT** to leave the alarm menu field.

The following alarms are currently supported:

- **LOW FORWARD POWER**
- **HIGH REFLECTED POWER**
- **EXT LOW FORWARD POWER**
- **EXT HIGH REFLECTED POWER**
- **REDUNDANCY SWITCHOVER**
- **PA FAN**
- **SYNTH OUT OF LOCK**
- **BATTERY REVERT**
- **SYS TIMER EXPIRED**
- **PA FAIL**
- **STATION RESET**
- **HIGH STABILITY REF FAIL**
- **ALIGNMENT ID MISMATCHED**

Alarm Setup

The Alarm Setup menu lets you set up station alarm conditions. Each item on the menu is described, followed by the setup procedure.

Forward Power Alarm Point

This item lets you set the Forward Power Alarm Point. Forward rf power is measured whenever the station is keyed. If the forward rf power falls below the set alarm point, a **LOW FORWARD POWER** alarm is set. The alarm point range is from 0 to 350 W, in 1 W increments.

Reflected Power Alarm Point

This item lets you set the Reflected Power Alarm Point. Reflected rf power is measured whenever the station is keyed. If the reflected rf power rises above the set alarm point, a **HIGH REFLECTED POWER** alarm is set. The alarm point range is from 0 to 350 W, in 1 W increments.

External Wattmeter Forward Power Alarm Point

This item lets you set the External Wattmeter Forward Power Alarm Point if the station includes Option X676 or Option X677 External Circulator with External Wattmeter. External wattmeter forward rf power is measured whenever the station is keyed. If the external wattmeter forward rf power falls below the set alarm point, an **EXT LOW FORWARD POWER** alarm is set. The alarm point range is from 0 to 350 W, in 1 W increments.

External Wattmeter Reflected Power Alarm Point

This item lets you set the External Wattmeter Reflected Power Alarm Poin if the station includes Option X676 or Option X677 External Circulator with external wattmeter. External wattmeter reflected rf power is measured whenever the station is keyed. If the external wattmeter reflected rf power rises above the set alarm point, an **EXT HIGH REFLECTED POWER** alarm is set. The alarm point range is from 0 to 350 W, in 1 W increments.

Procedure

Step 1. From the **READY** prompt, press the **ASET** key to enter the Alarm Setup menu. Press the ▼ key until the menu item you want to change is displayed.

Step 2. Press the **ENT** key. The display shows ***(type of alarm)* ALM PT xxx W** (flashing) where xxx is the current alarm point value

Step 3. Enter the desired alarm point value using the digit keys, followed by the **ENT** key. The display shows ***(type of alarm)* ALM PT yyy W**, where yyy is the newly entered alarm point value.

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Alarm Definitions

- **LOW FORWARD POWER**

  This alarm is set active if forward rf power drops below the Forward Power Alarm Point (**FWD PWR ALM PT** on the Alarm Setup menu) while the station is keyed.

  This alarm clears itself when a station key-up produces a forward rf power reading above the Forward Power Alarm Point.

- **HIGH REFLECTED POWER**

  This alarm is set active if reflected rf power rises above the Reflected Power Alarm Point (**RFL PWR ALM PT** on the Alarm Setup menu) while the station is keyed.

  This alarm clears itself when a station key-up produces a reflected rf power reading below the Reflected Power Alarm Point.

- **EXT LOW FORWARD POWER**

  This alarm is set active if forward rf power through the external wattmeter (part of Option X676 or X677 External Circulator) drops below the External Wattmeter Forward Power Alarm Point (**EXT WM FWD PWR ALM PT** on the Alarm Setup menu) while the station is keyed.

  This alarm clears itself when a station key-up produces an external wattmeter forward rf power reading above the External Wattmeter Forward Power Alarm Point.

- **EXT HIGH REFLECTED POWER**

  This alarm is set active if reflected rf power through the external wattmeter (part of Option X676 or X677 External Circulator) rises above the External Wattmeter Reflected Power Alarm Point (**EXT WM RFL PWR ALM PT** on the Alarm Setup menu) while the station is keyed.

  This alarm clears itself when a station key-up produces an external wattmeter reflected rf power reading below the External Wattmeter Reflected Power Alarm Point.

- **REDUNDANCY SWITCHOVER**

  This alarm is not currently supported.

- **PA FAN**

  This alarm is set active if a Power Amplifier Module fan fails.

  This alarm clears itself when all Power Amplifier Module fans are operating.

- **SYNTH OUT OF LOCK**

  This alarm is set active if an out-of-lock alarm from the Exciter Module is received.

  This alarm clears itself when the transmitter synthesizer becomes locked to the programmed frequency.

Alarm Definitions (continued)

- **BATTERY REVERT**

  This alarm is set active if the station switches to battery power.

  This alarm clears itself when the station switches back to ac power.

- **SYS TIMER EXPIRED**

  This alarm is set active if the station does not key for a period of time longer than the system timer alarm threshold (**SYS TIMER ALM** on the Station menu). The system timer is reset every time the station keys.

  This alarm clears itself after every station key-up, or can be cleared using the Alarms menu.

- **PA FAIL**

  This alarm is set active if the Power Amplifier Module or a PA fan fails.

  This alarm clears itself when the Power Amplifier Module or fan resumes operation.

- **STATION RESET**

  This alarm is set active if the station is reset for any reason.

  This alarm remains active until cleared using the Alarms menu.

- **HIGH STABILITY REF FAIL**

  This alarm is set active if the optional UHSO or HSO on the Reference Module fails.

  This alarm clears itself when the UHSO or HSO resumes operation.

- **ALIGNMENT ID MISMATCHED**

  This alarm is set on station start-up or reset if the Alignment ID of the Station Control Board does not match the Alignment ID of the Exciter Module. The Exciter Module and Station Control Board are aligned in the factory together as a matched pair and are assigned a common Alignment ID number. Use **SOFTWARE VERSIONS** on the Station Status menu to display these ID numbers.

  While this alarm is active, the station may perform 2-level paging, ***but 4-level paging is disabled.***

  This alarm remains active until cleared using the Alarms menu.

16 STATION STATUS AND ACCESS

Station Status Menu

The Station Status menu lets you view various station parameters without interrupting paging operations. No parameters can be entered or changed from these menu fields.

Press the **STAT** key to enter the Station Status menu. Press the ▲ or ▼ key to scroll through the menu items.

Forward Power

This entry allows you to view the forward power value from the last station keyup.

Reflected Power

This entry allows you to view the reflected power value from the last station keyup.

VSWR

This entry allows you to view the Voltage Standing Wave Ratio (VSWR) value from the last station keyup.

External Wattmeter Forward Power

This entry allows you to view the external wattmeter forward power value from the last station keyup.

External Wattmeter Reflected Power

This entry allows you to view the external wattmeter reflected power value from the last station keyup.

External Wattmeter VSWR

This entry allows you to view the external wattmeter VSWR value from the last station keyup.

Software Versions

This entry allows you to view the current software versions of the various installed components.

Access Disable Menu

The Access Disable menu allows you to disable the *Nucleus* Paging Station from certain remote requests, and to display active disable status indications.

Maintenance Access

The **MAINT ACCESS** parameter, when set to **ENABLED**, inhibits the station from remote keyup requests while allowing the station to key locally. The station will be disabled from remote keying and diagnostics.

Step 1. From the **READY** prompt, press the **DIS** key to enter the Access Disable menu. Press the ▼ key until **MAINT ACCESS: DISABLED** (or **: ENABLED**) is displayed.

Step 2. Press the **ENT** key. The display shows **DISABLED** (or **ENABLED**) (flashing).

Step 3. Press the **TOG** key to change the setting, followed by **ENT.** The display shows **MAINT ACCESS: ENABLED** (or **: DISABLED**).

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Paging Access

When the **PAGING ACCESS** parameter is set to **DISABLED**, remote paging keyups are inhibited but remote diagnostic access is allowed.

Step 1. From the **READY** prompt, press the **DIS** key to enter the Access Disable menu. Press the ▼ key until **PAGING ACCESS: ENABLED** (or **: DISABLED**) is displayed.

Step 2. Press the **ENT** key. The display shows **ENABLED** (or **DISABLED**) (flashing).

Step 3. Press the **TOG** key to change the setting, followed by **ENT.** The display shows **PAGING ACCESS: DISABLED** (or **: ENABLED**).

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Disable Status

The Disable Status sub-menu displays any active disable status indications.

Step 1. From the **READY** prompt, press the **DIS** key to enter the Access Disable menu. Press the ▼ key until **DISABLE STATUS** is displayed.

Step 2. Press the **ENT** key. The display shows the first disable status indication (if any).

Step 3. Press the ▼ key to scroll through any other active disable status indications.

Step 4. Press the **EXIT** key to return to the **READY** prompt.

Service Mode Menu

WARNING

The PA Test Mode allows the transmitter to key even if a power amplifier fault condition exists (such as high VSWR or high temperature). Protective power reductions do not take place in this mode. Thus, the station can produce potentially hazardous levels of rf power, and the Power Amplifier Module can be damaged.

Use extreme caution when invoking this mode. Before using this mode, reduce the transmit power level using TX CHN PWR on the TX menu.

Press the **SERV** key to enter the Service Mode menu.

PA Test Mode

Power Amplifier Module problems may be difficult to diagnose because the power control circuitry does not allow the station to remain keyed with a power amplifier fault for more than 5 minutes. The PA Test Mode allows the transmitter to key even if a power amplifier fault exists, so that the fault may be diagnosed. See **WARNING** at left.

The **PA Fail** LED (on the Exciter Module front panel) flashes in the PA Test Mode.

Select Symbol

This item allows you to choose which symbol pattern the station will transmit when using the **KEY ON SYMBOL** function (described below). Symbol patterns include:

STAIRCASE (station transmits the following cycle of symbols repeatedly: 10, 11, 01, 00)
01–10 (station alternately transmits symbols 01 and 10)
00–11 (station alternately transmits symbols 00 and 11)
10
11
01
00
CARRIER

Key on Symbol

The **KEY ON SYMBOL** function allows you to verify proper 4-level paging alignment by transmitting test patterns comprised of various paging data symbols (described above).

If you press the **ENTER** key when **KEY ON SYMBOL** is displayed, the Control front panel displays **TRANSMITTING SYMBOL**, and the station keys according to the selection under **SELECT SYMBOL** (described above). During this time, the front panel disregards all keypresses except the **EXIT** key. When you press the **EXIT** key, the station will dekey and the front panel again displays **KEY ON SYMBOL**.

17 ROUTINE MAINTENANCE

This section provides routine maintenance recommendations and procedures for the *Nucleus* Paging Station.

Routine Maintenance Overview

Nucleus Paging Station operating parameters are self-monitored and corrected, making periodic adjustments and tuning mostly unnecessary. If the equipment is installed in an area that meets the environmental requirements in Section 3 – *Installation Overview*, the only routine maintenance task required is calibration of the station reference oscillator.

The station reference oscillator may be any of the following:

- Internal NIU oscillator
- UHSO in station Reference Module
- HSO in station Reference Module
- External reference

Calibration procedures for the Internal NIU, UHSO, and HSO are described in this section. For an external reference, refer to the manufacturer's instructions.

Air Filtering

If the station equipment is installed in a particularly dusty environment, precautions must be taken to filter the air used for forced cooling of the station. Excessive dust drawn across and into the station circuit modules by the cooling fans can adversely affect heat dissipation and circuit operation. In such installations, be sure to clean or replace external filtering devices periodically. Refer to Section 3 – *Installation Overview* for air quality requirements.

Recommended Test Equipment

- Motorola R2000 Series Communications Analyzer with optional external frequency standard (or equivalent) (refer to Table 17–1 for accuracy requirements)
- Frequency Counter with optional external frequency standard (since the short-term stability of the Internal NIU oscillator is approximately 30 ppb, it is recommended that a frequency counter of 10 x or greater accuracy be used)
- IBM PC (or compatible) ***for Internal NIU oscillator only***

Calibrating Internal NIU Oscillator

IMPORTANT

NIU oscillator adjustment should be performed only after the NIU has been powered up for at least one hour. Since the short-term stability of the oscillator is approximately 30 ppb, it is recommended that a frequency counter of 10 x or greater accuracy be used to ensure an accurate alignment. The frequency counter should be allowed to warm up and be calibrated per the manufacturer's instructions.

CAUTION

If using a satellite distribution system, remove power from the satellite receiver ***before*** disconnecting the antenna lead to the satellite dish.

IMPORTANT

When using the Internal NIU as the station frequency reference, S8, pole 1 must be set to **OFF**.

S8, pole 2 must be set to **ON**.

(See Figure 17–1 for DIP switch location.)

Overview

Internal NIU oscillator adjustment may be needed as a result of normal component aging. This is indicated by NIU software alarm 14: **DAC hi/low limit**. Since this alarm may occur falsely at power-up, use the NIU software **show status** command to check the DA value, which alarms when it approaches its upper or lower limits (0 and 16383).

Procedure for Station without UHSO or HSO in Reference Module

Step 5. Remove station Control front panel mounting screws. Slide front panel outward until free from cage. Leave ribbon cable connected between front panel and Station Control Board (SCB).

Step 6. On the NIU board, remove oscillator tuning slug cover screw. Refer to Figure 17–1 for location. Save screw for later use.

Step 7. Disconnect any C-NET sources connected to station Backplane. See **CAUTION** notice at left. If necessary, tag lines or draw a diagram to facilitate reconnection of lines when procedure is completed.

Step 8. Connect a frequency counter, capable of 1 Hz resolution, to the front-panel BNC connector on the SCB or to BNC connector J30 on the station Backplane.

Step 9. Establish communications with the NIU via the **Console** connector. Refer to the Console User Interface description in Section 13 – *Internal NIU Configuration* for procedures. Ensure communications are established and log on to the **NUCNIU> password** prompt.

Step 10. Type the following command: **set osc** <ENTER>. The NIU will automatically turn off the phase-locked loop (PLL) and set the digital-to-analog converter (DA) value to zero (0) (minimum voltage).

Step 11. Adjust the oscillator tuning screw for a −15 Hz (−3 ppm) frequency error from 5 MHz (4.999985 MHz).

Step 12. Press the <ENTER> key. The NIU will automatically set the DA value to 16383 (maximum voltage).

Step 13. Adjust potentiometer R29 (located below upper two LEDs on NIU front edge) for a +15 Hz (+3 ppm) frequency error from 5 MHz (5.000015 MHz).

Step 14. Press the <ENTER> key. The NIU will automatically set the DA value to 8192 (midpoint voltage). The frequency counter should indicate 5.000000 MHz with little or no error.

Step 15. Disconnect frequency counter from BNC connector test point on SCB or station Backplane.

Step 16. Replace oscillator tuning cover screw in oscillator housing.

Step 17. Reinstall station Control front panel and secure with screws removed in Step 5.

Step 18. Reconnect any C-NET interface lines disconnected in Step 7.

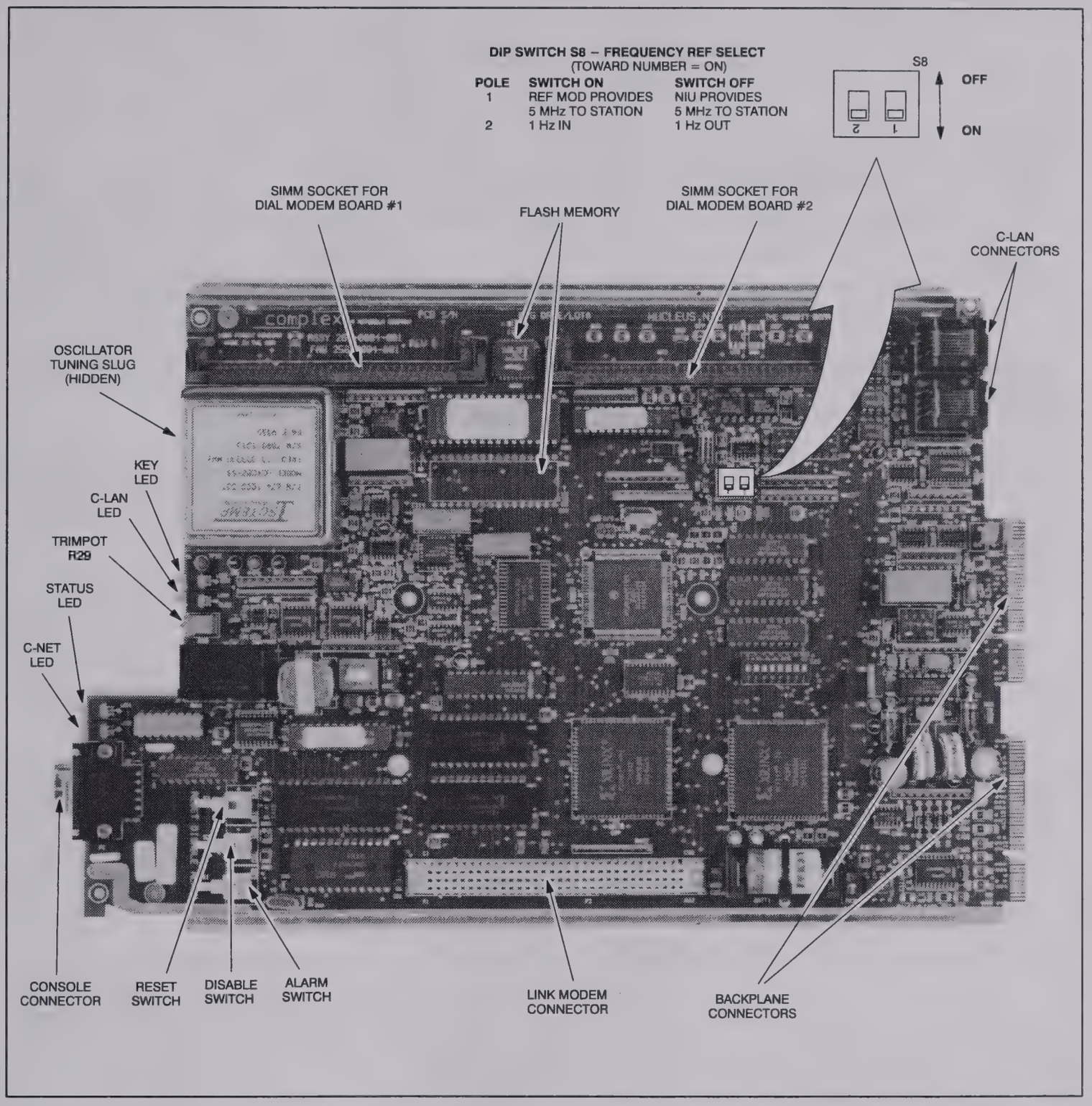


Figure 17–1. *Internal NIU Component Locations*

Calibrating Internal NIU Oscillator (continued)

CAUTION

Observe proper static handling procedures when removing, installing, and changing DIP switch settings on the NIU.

IMPORTANT

NIU oscillator adjustment should be performed only after the NIU has been powered up for at least one hour. Since the short-term stability of the oscillator is approximately 30 ppb, it is recommended that a frequency counter of 10 x or greater accuracy be used to ensure an accurate alignment. The frequency counter should be allowed to warm up and be calibrated per the manufacturer's instructions.

CAUTION

If using a satellite distribution system, remove power from the satellite receiver ***before*** disconnecting the antenna lead to the satellite dish.

Procedure for Station with UHSO or HSO in Reference Module

Note: This procedure requires taking the station temporarily out of service.

Step 1. Power down the *Nucleus* Paging Station.

Step 2. Remove station Control front panel mounting screws. Slide front panel outward until free from cage. Leave ribbon cable connected between front panel and Station Control Board (SCB).

Step 3. Remove NIU board from cage by pulling firmly outward. (Use card-puller extension at bottom of inside front panel.) Place board on a clean, static-free surface with components upward.

Step 4. Remove station Reference Module front panel mounting screws. Disconnect the Reference Module from the Backplane by pulling firmly outward a few inches.

Step 5. On NIU board, set DIP switch S8 pole 1 to the OFF (UP) position (away from switch number) and S8 pole 2 to the ON (DOWN) position (toward switch number). Refer to Figure 17–1 for DIP switch location.

Step 6. On NIU board, remove oscillator tuning slug cover screw. Refer to Figure 17–1 for location. Save screw for later use.

Step 7. Reinstall NIU board in station. Press in firmly to seat board into Backplane connectors but ***do not force***. Leave station Control front panel connected but do not reinstall into cage.

Step 8. Power up station and allow to warm up for at least one hour before proceeding.

Step 9. Disconnect any C-NET sources connected to station Backplane. See **CAUTION** notice at left. If necessary, tag lines or draw a diagram to facilitate reconnection of lines when procedure is completed.

Step 10. Connect a frequency counter, capable of 1 Hz resolution, to the front-panel BNC connector on the SCB or to BNC connector J30 on the station Backplane.

Step 11. Establish communications with the NIU via the **Console** connector. Refer to the Console User Interface description in Section 13 – *Internal NIU Configuration* for procedures. Ensure communications are established and log on to the **NUCNIU> password** prompt.

Calibrating Internal NIU Oscillator (continued)

CAUTION

Observe proper static handling procedures when removing, installing, and changing DIP switch settings on the NIU.

IMPORTANT

If the station has an Internal NIU *and* a Reference Module with a UHSO/HSO, DIP switch S8 on the Internal NIU must be set correctly:

When using a Reference Module with a UHSO/HSO as the station frequency reference, S8, pole 1 must be set to **ON** (DOWN).

When using the Internal NIU as the station frequency reference, S8, pole 1 must be set to **OFF** (UP).

In all cases, S8, pole 2 must be set to **ON** (DOWN).

(See Figure 17–1 for DIP switch location.)

Step 12. Type the following command: **set osc** <ENTER>. The NIU will automatically turn off the phase-locked loop (PLL) and set the digital-to-analog converter (DA) value to zero (0) (minimum voltage).

Step 13. Adjust the oscillator tuning screw for a −15 Hz (−3 ppm) frequency error from 5 MHz (4.999985 MHz).

Step 14. Press the <ENTER> key. The NIU will automatically set the DA value to 16383 (maximum voltage).

Step 15. Adjust potentiometer R29 (located below upper two LEDs on NIU front edge) for a +15 Hz (+3 ppm) frequency error from 5 MHz (5.000015 MHz).

Step 16. Press the <ENTER> key. The NIU will automatically set the DA value to 8192 (midpoint voltage). The frequency counter should indicate 5.000000 MHz with little or no error.

Step 17. Power down the station. Disconnect frequency counter from BNC connector test point on SCB or station Backplane.

Step 18. Remove NIU board from cage by pulling firmly outward. Place board on a clean, static-free surface with components upward.

Step 19. On NIU board, reset DIP switch S8 pole 1 to the ON (DOWN) position. (See **IMPORTANT** notice at left.)

Step 20. Reinstall the Reference Module into the Backplane. Press in firmly to seat module into Backplane connectors but ***do not force***. Reinstall Reference Module front panel mounting screws.

Step 21. On NIU board, replace oscillator tuning cover screw in oscillator housing.

Step 22. Reinstall NIU board in station. Press in firmly to seat board into Backplane connectors but ***do not force***.

Step 23. Reinstall station Control front panel and secure with screws removed in Step 5.

Step 24. Reconnect any C-NET interface lines disconnected in Step 7.

Step 25. Power up the station and resume normal operation.

Calibrating UHSO or HSO in Reference Module *(for station without Internal NIU or external reference)*

The circuit devices responsible for determining the UHSO or HSO reference frequency exhibit slight variations in their operating characteristics over time ("infant aging"). Approximately 90% of the component aging process occurs during the first year of operation. After the initial one-year period, the devices remain stable for a substantially longer period of time. Therefore, it is recommended that the station reference oscillator be calibrated after one year of operation, and thereafter less often as prescribed in a recommended schedule of periodic calibration.

UHSO/HSO Calibration Schedule

After performing the initial one year calibration procedure, periodic calibration is required according to the schedule shown in Table 17−1. Note that the intervals are affected by the accuracy (in ppm) required either for FCC compliance or by the system requirements, whichever is more stringent.

Table 17−1. *Recommended Intervals for Calibrating UHSO or HSO (After Initial One-Year Calibration)*

Accuracy Desired/Required*		Recommended Interval
UHSO in Reference Module	HSO in Reference Module	
±0.125 ppm	±1.25 ppm	Every 4 years
±0.065 ppm	±0.65 ppm	Every 2 years
±0.035 ppm	±0.35 ppm	Every 1 year

*It is recommended that the frequency measurement equipment have an accuracy tens times greater than the accuracy required by the measurement. For example, if the frequency must be measured to within ± 0.035 ppm, the accuracy of the measurement equipment should be ± 0.0035 ppm (± 3.5 ppb).

UHSO/HSO Calibration Procedure

Perform the following procedure to calibrate the UHSO or HSO.

Step 1. Perform necessary setup for frequency measuring equipment (for example, a Motorola R2000 Series Communications Analyzer with optional external frequency standard).

Step 2. Perform the *UHSO/HSO Alignment* procedure in Section 14 − *Station Alignment*. Refer to *Test Equipment Setup* there for test equipment interconnections.

18 TROUBLESHOOTING

Use this section to isolate *Nucleus* Paging Station faults to the module level. The troubleshooting and repair philosophy for the *Nucleus* Paging Station is one of Field Replaceable Unit (FRU) substitution. When you determine a station module (FRU) to be faulty, replace it with a known good module to quickly bring the station back to normal operation. Then ship the faulty module to a Motorola repair depot for further troubleshooting and repair to the component level.

Module replacement procedures are given in Section 19.

Reading and Clearing Alarms

Press the **ALMS** key to display station alarms. If there are no alarms active, the display will show **NO ALARMS**. If there are active alarms, the first alarm message will be displayed. Press the ▲ or ▼ key to scroll through any other active alarms.

Alarm descriptions are given in Section 15.

Station Status Menu

The Station Status menu lets you view various station parameters without interrupting paging operations. Press the **STAT** key to enter the Station Status menu. Press the ▲ or ▼ key to scroll through the menu items.

Station Status menu descriptions are given in Section 16.

Access Disable Menu

The Access Disable menu allows you to disable the *Nucleus* Paging Station from certain remote requests, and to display active disable status indications. Access Disable menu descriptions are given in Section 16.

Service Mode Menu

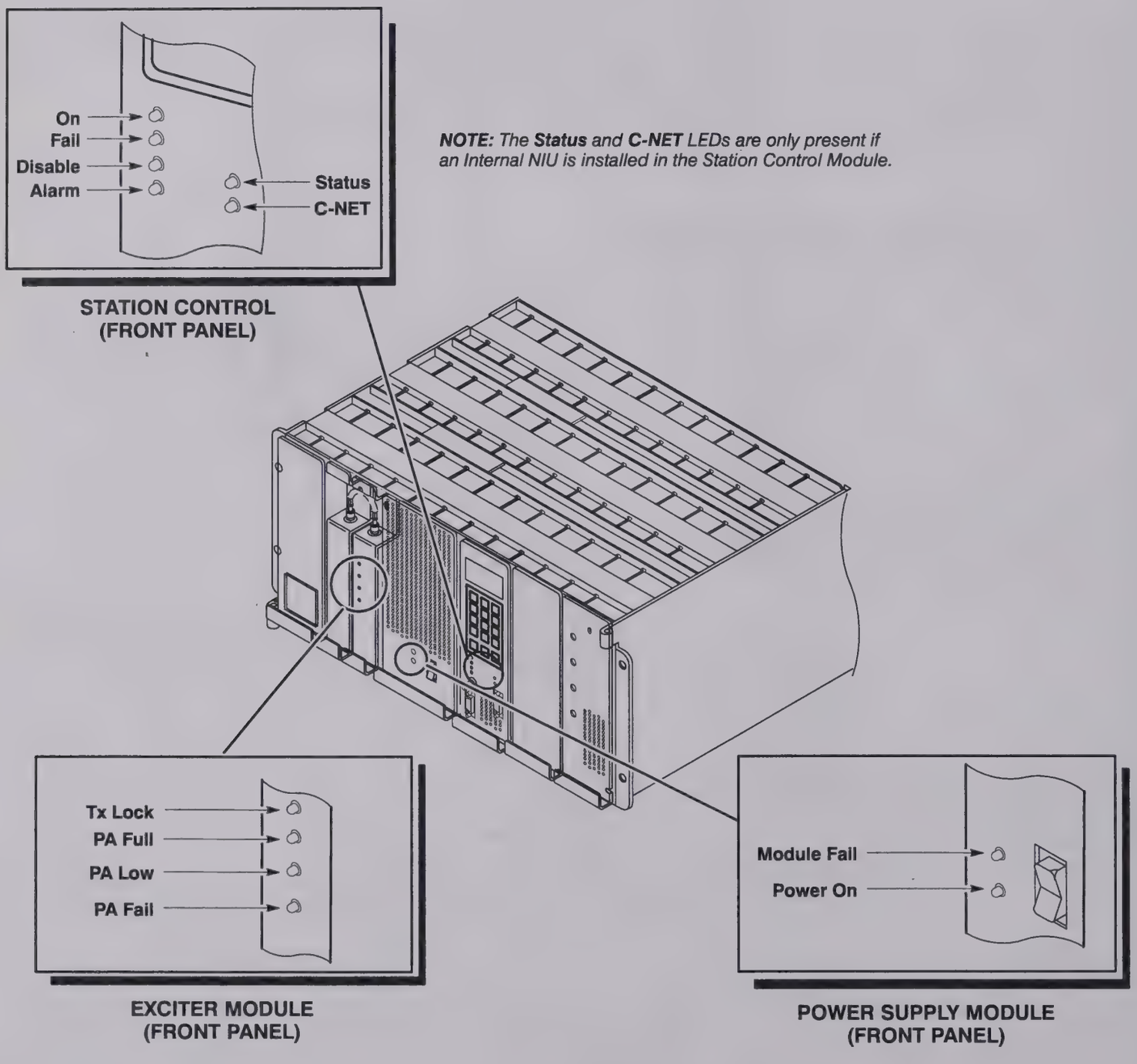
The Service Mode menu provides the PA Test Mode and the Key on Symbol function. Service Mode menu descriptions are given in Section 16.

Interpreting LED Indicators

LED indicators on the front panels of the modules indicate specific operating conditions. Observe these LEDs to obtain a quick status indication of the station equipment.

Figure 18–1 shows LED locations. Table 18–1 lists status descriptions for each LED.

If a problem is indicated that needs troubleshooting, perform the Verifying Transmitter Circuitry procedure on the pages following Table 18–1.



***NOTE:** The **Status** and **C-NET** LEDs are only present if an Internal NIU is installed in the Station Control Module.*

Figure 18–1. Nucleus *Paging Station LED Indicators*

Table 18–1. Nucleus *Paging Station LED Indicator Functions*

LED Location	LED Name	Status Definition
EXCITER MODULE	Tx Lock	– GREEN when Exciter synthesizer is locked; module fully functional. – OFF when: synthesizer is out of lock **or** +5 V, +14.2 V, or both are absent
	PA Full	– GREEN when transmitter is keyed and PA output power is at expected power level – OFF when: PA not keyed **or** PA keyed but PA output power is **not** at expected power level
	PA Low	– YELLOW when transmitter is keyed and PA output power is less than expected power level but not shut down (for example, during power cutback mode) – OFF when: PA not keyed **or** PA keyed and PA output power is at expected power level
	PA Fail	– RED when: No PA output power (for example, during PA shutdown mode); LED status is latched, thereby indicating status during current key or for previous key **or** One or both of the PA cooling fans fail **or** Final PA VSWR Alarm is activated (VSWR internal to PA is higher than maximum programmed in station software; not field programmable. Note that a bad antenna or rf cables external to PA module will not cause this LED to light.) **or** (High power models only) Overdrive alarm is generated by Driver PA – FLASHING when PA Test Mode is active – OFF when PA output power is either at expected level or at specific cutback levels (any level other than shutdown); LED status is latched, thereby indicating status during current key or for previous key
POWER SUPPLY MODULE	Module Fail	– OFF during normal operation. – RED when module malfunction occurs, such as shorted output, current limit exceeded, loss of communication with Station Control Module, etc.
	Power On	– GREEN with ac input power present and switch turned ON – OFF when ac input power absent or switch turned OFF

Table 18–1. Nucleus *Paging Station LED Indicator Functions (continued)*

LED Location	LED Name	Status Definition
STATION CONTROL FRONT PANEL ***NOTE**: The **Status** and **C-NET** LEDs are present only if an Internal NIU is installed in the Station Control Module.*	**On**	– GREEN when SCM fully functional – OFF for SCM failure
	Fail	– RED for SCM failure – FLASHES when a software checksum failure is detected – OFF when SCM fully functional (no failure)
	Disable	– RED when station is disabled from remote keying (when maintenance access or paging access is disabled) – FLASHES when DRAM address lines are open – OFF when SCM is enabled and fully functional
	Alarm	– RED for active station alarm (go to Alarms Menu to check) – FLASHING when DRAM address lines are shorted – OFF when SCM is fully functional and no alarms
	Status	– FLASHES GREEN SLOWLY when Internal NIU status is normal, no alarms – FLASHES GREEN FAST when Internal NIU dial modem has DCD connected – FLASHES ORANGE SLOWLY when Internal NIU alarm exists or has occurred – FLASHES ORANGE FAST when Internal NIU alarm exists or has occurred and dial modem is connected – RED for Internal NIU malfunction
	C-NET	– GREEN when C-NET has sync – FLASHES GREEN SLOWLY when C-NET has sync and running ROM memory – ORANGE when C-NET lost sync for less than 30 seconds – FLASHES ORANGE SLOWLY when C-NET lost sync for less than 30 seconds and running ROM memory – RED when C-NET lost sync for more than 60 seconds – FLASHES RED when C-NET lost sync for more than 60 seconds and running ROM memory – OFF when squelch active, no C-NET sync

Notes:

1. All LEDs momentarily light following station reset or upon station power-up.
2. If no LED indicators are on, make sure that power to the station power supply is present. Check the circuit breaker at the power source. Check the power line cord. If no problem is found, suspect the Power Supply Module.
3. If all module indications are normal but wildcard inputs and/or outputs do not function normally, replace the Wildcard board.

Verifying Transmitter Circuitry

IMPORTANT

Performing this procedure requires that the station be taken out of service. It is recommended that, unless the station is already out of service due to an equipment malfunction, this procedure be performed during off-peak hours so as to minimize the disruption of service to the system subscribers.

Introduction

Use the following procedure to verify proper operation of the station transmit circuitry, including:

- Exciter Module
- Power Amplifier Module
- Power Supply Module
- Reference Module
- 16.8 MHz Reference Oscillator circuitry
- Transmitter-related circuitry on the Station Control Board (SCB)

In general, the transmitter circuitry is exercised by injecting and measuring signals using a Motorola R2000 Series Communications Analyzer (or equivalent). Incorrect measurement values indicate a faulty module(s); measurement values within the acceptable range verify proper operation of the above listed modules and circuitry.

Required Test Equipment

The following test equipment is required to perform the procedure:

- Motorola R2000 Series Communications Analyzer (or equivalent)
- In-Line Wattmeter (Motorola Model S-1350 or equivalent)
- Dummy Load (50 Ω , station wattage or higher)

Test Equipment Setup

Connect the test equipment to the Paging Station as shown in Figure 18–2.

IMPORTANT

The in-line wattmeter must be connected directly to the station transmit output cable, which is attached to the outer row of the 6-hole bracket on the Backplane at the rear of the station (see Section 8 – *RF Connections*). Be sure to use proper connectors, with no adapters or intermediate cables between the transmit output cable connector (Type N) and the wattmeter.

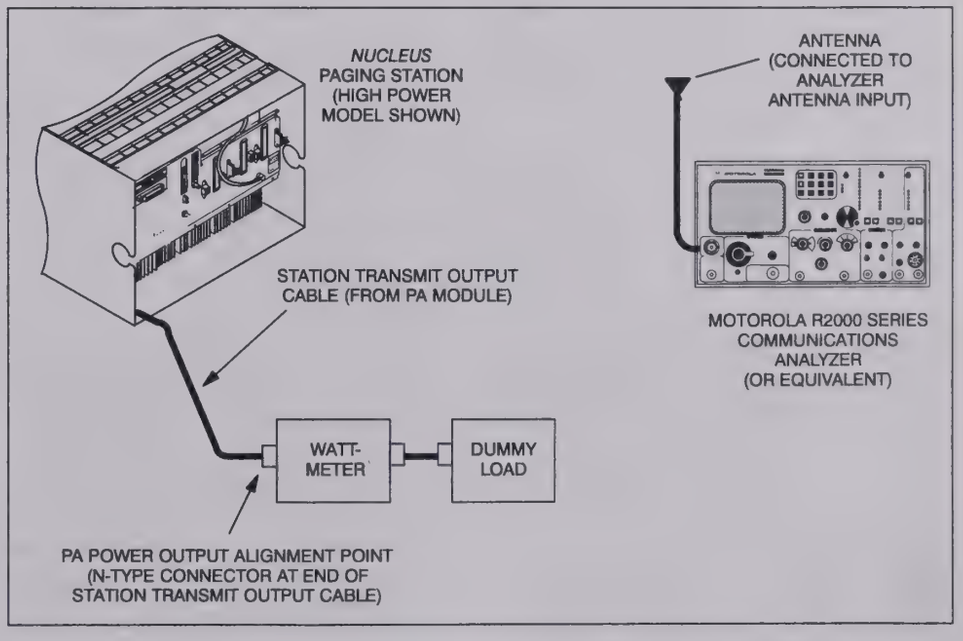


Figure 18–2. *Test Equipment Setup for Verifying Transmitter Circuitry*

Verifying Transmitter Circuitry (continued)

NOTE: *Suspected faulty modules are shown ranked in order of most to least likelihood.*

Verifying Transmitter Circuitry Procedure

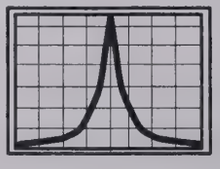
Step 1. Key the transmitter with silent carrier and observe LED indicators on Exciter Module front panel.

- If **PA Low** or **PA Fail** LED is lit, suspect the following:
  - Power Amplifier Module failure
  - Exciter Module failure
  - Loose or bad Exciter-to-PA rf cable
  - Loose or bad PA-to-antenna rf output cable
  - PA rf output cable not properly terminated
  - Station not properly power calibrated
  - Station operating power not properly set
- If **Tx Lock** LED is off, suspect the following:
  - Tx VCO out of tune
  - Faulty Station Control Module
  - Faulty Exciter Module
  - Faulty Backplane
  - No frequency programmed on current channel
  - Possible hardware mismatch

Step 2. Measure output power by keying the transmitter with silent carrier and observing reading on in-line wattmeter.

- If PA output not at proper power (as set for particular site), adjust the station power output as described in Section 14 – *Station Alignment*.

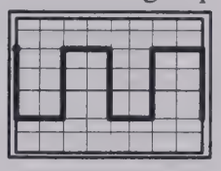
Step 3. If PA output power is OK, set up the Communications Analyzer for spectrum analyzer display. Key the transmitter with silent carrier and observe the display. The display should look similar to the figure at right:



- If the display shows multiple carriers evenly spaced about the carrier, suspect a faulty PA Module.
- If the display shows a solid carrier but off frequency, suspect the following:
  - Tx VCO out of tune
  - Faulty Exciter or Station Control Module
  - Faulty 5 MHz from Reference Module or external source
  - 5 MHz source not tuned correctly
  - **HIGH SPEED OFFSET** or **LOW SPEED OFFSET** (on Transmit menu) not equal to 0
- If the display shows a single carrier moving erratically, suspect:
  - Faulty Station Control Module
  - Faulty Exciter Module
  - Faulty PA Module
  - Faulty Reference Module

Verifying Transmitter Circuitry (continued)

Step 4. If display is OK, set up the Communications Analyzer to display modulation. Key the transmitter with High Speed Data (HSD). Verify that the display looks similar to the figure at right:



- If the proper display is not obtained, suspect a faulty SCM or Exciter Module.

Step 5. Set the Communications Analyzer for GEN/MON MTR. Key the transmitter with High Speed Data (HSD). Display should read ±5 kHz maximum.

- If proper display is not obtained, suspect a faulty SCM or Exciter Module.

Step 6. This completes the *Verifying Transmitter Circuitry* test procedure. If all displays and measurements are correct, the transmitter circuitry may be considered to be operating properly. Remove test equipment and restore the station to normal service.

Monitoring Receiver Module Output

The same Receiver Module can be configured either as a link receiver or as a monitor receiver.

If the receiver is configured as a link, the audio output may be monitored on signal LINK RX AUDIO on Backplane DB-9 connector J19, pin 5 (J19, pin 1 is ground).

If the receiver is configured as a monitor, the analog audio or TTL output (depending on **MONITOR RX OUTPUT** configuration) may be monitored on signal MONITOR RX AUDIO on 50-pin Backplane connector J17, pin 47 (J17, pins 7, 32, and 34 are ground).

These outputs should be monitored with a high-input impedance device, such as an oscilloscope input or a telephone test set on "bridge" setting. Nominal output level is fixed at −5 dBm (436 mV rms) for 60% of full system deviation, with a dc output bias of 5 V.

Internal NIU Troubleshooting

Overview

To troubleshoot the *Nucleus* Internal NIU, observe the LED indicators during operation. The troubleshooting chart in Figure 18–3 should provide adequate information for determining if the NIU is functioning properly in the paging station environment. See Section 19 – *Module Replacement Procedures* for the *Internal NIU Board* procedure.

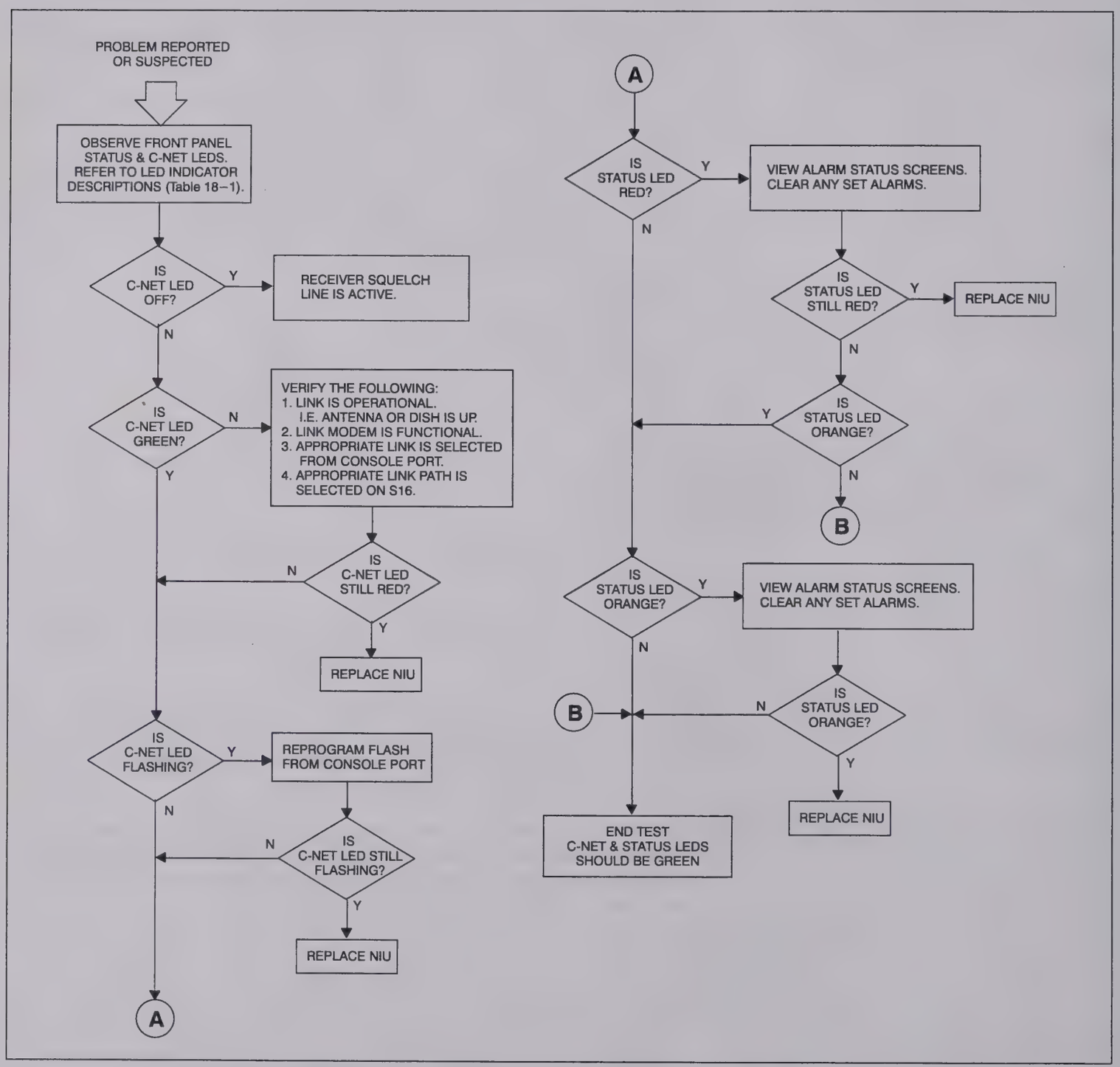


Figure 18–3. *Internal NIU Troubleshooting Flowchart*

19 MODULE REPLACEMENT PROCEDURES

Station modules suspected of being faulty must be replaced with known good modules to restore the station to proper operation. The following procedures provide instructions for replacing each of the station modules and performing any required post-replacement adjustments or programming.

General Replacement Information

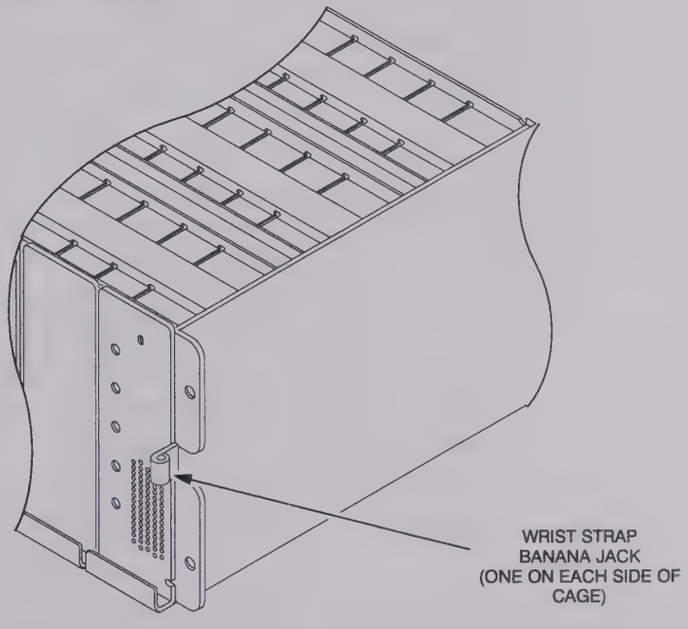
WARNING

When wearing the conductive wrist strap, be careful near sources of high voltage. The good ground provided by the wrist strap will also increase the danger of lethal shock from accidentally touching high voltage sources.

Anti-Static Precaution

The station circuitry contains many CMOS and other static-sensitive devices. When servicing the equipment, you must take precautionary steps to prevent damage to the modules from static discharge.

- A wrist strap (Motorola Part No. 4280385A59, or equivalent) should be worn while servicing to minimize static buildup. Banana jacks are built into the station cage for connection of the wrist strap. Refer to **WARNING** at left.



CAUTION

Do not insert or remove station modules with power applied. This may result in damage to the modules. For high power stations, be sure ***both*** power On/Off (0/1) switches are set to Off (0).

If the station has ac power with a battery revert option (X30 or X43), first disconnect the batteries, then turn the power On/Off switch(es) to Off (0). When restoring power after module replacement, first turn the power On/Off switch(es) to On (1), then reconnect the batteries.
If the station has dc power, turn the power On/Off switch(es) to Off (0), but do not disconnect the batteries.

- *Do not* insert or remove modules with power applied. Always turn off station power using the On/Off (0/1) switch(es) located on the Power Supply Module(s) before inserting or removing modules. Refer to **CAUTION** at left.

  If the station has ac power with a battery revert option (X30 or X43), first disconnect the batteries, then turn the power On/Off switch(es) to Off (0). When restoring power after module replacement, first turn the power On/Off switch(es) to On (1), then reconnect the batteries.

- All spare modules should be kept in a conductive bag for storage and transporting. When shipping modules to the repair depot, always pack in conductive material.

General Replacement Information (continued)

Releasing Module Mechanical Restraints

Each module in the station cage slides in on rails built into the station cage and plugs into a connector(s) on the station Backplane. Each module is held in place by a mounting screw at the top and the bottom.

Note that the two mounting screws must be completely removed before removing each of the station modules. A *TORX*® screwdriver with T-15 bit is required to remove the screws. Additional removal steps are described in the replacement procedures for each module.

Care of Gold-Plated Connector Contacts

The connections between the modules and the station Backplane board are made with gold-plated card edge connector contacts to provide maximum reliability. Gold-plated materials do not form a non-conductive oxide layer, and therefore should not require cleaning under normal conditions.

When the modules have been subjected to many extraction/insertion cycles, or if the station is operated in a dusty environment, the contacts may require cleaning. ***Do not*** use an eraser or any type of abrasive substance to clean either the module card-edge connectors or the Backplane connector contacts. Any type of abrasive cleaning (typically employed for cleaning non gold-plated contacts) can result in the removal of the gold plating or bending of the connector contacts.

If cleaning of the gold-plated contacts is required, use a soft cloth dampened with alcohol to lightly wipe the contacts. Be sure not to touch the contact surfaces with your fingers, as finger oils and salts can contaminate the contact surfaces.

Validating Repairs

After replacing a faulty module with a known good module, perform one of the following tests to validate the repair before leaving the site.

- If the faulty module was detected as the result of running station diagnostics via the control panel/station serial port, run the diagnostics again after the repair is made to ensure that the replacement module passes all diagnostic tests.
- If the faulty module was detected by an operational failure, perform the operation to ensure that the repair corrected the reported/detected failure.

Standard Power Amplifier Module

Standard Power Amplifier Modules are rated at 125 W or less.

Replacement Procedure

Step 1. Connect static wrist strap connector into receptacle located on either side of station chassis.

Step 2. Turn off station power using Power Supply Module On/Off switch. ***If the station has ac power with a battery revert option (X30 or X43),*** first disconnect the batteries, then turn the power On/Off switch to Off (0).

If the station has ac power with a battery revert option (X30 or X43), first disconnect the batteries, then turn the power On/Off switch(es) to Off (0). When restoring power after module replacement, first turn the power On/Off switch(es) to On (1), then reconnect the batteries.

Step 3. Remove front-panel mounting screws from top and bottom of Low Power Amplifier module front panel.

Step 4. Disconnect mini-UHF connector on rf cable connecting Exciter Module to Power Amplifier Module.

Step 5. Slide the module partially out. Disconnect the N-type connector (rf output from the module) from the lower left side of module.

Step 6. Remove faulty module from cage.

Step 7. Install replacement Power Amplifier Module by sliding module partially into cage (module about 2 inches from full insertion). Connect the rf output cable to the N-type connector at the lower left side of the module.

Step 8. Slide the module in completely and firmly seat the module connector into the Backplane. ***Do not force the module into the Backplane connectors. Use moderate pressure and rock the module slightly until it is completely seated.***

Step 9. Reconnect the rf cable from the Exciter Module.

Step 10. Secure module with two mounting screws removed in Step 3.

Step 11. Restore power to the station using Power Supply Module On/Off switch. ***If the station has ac power with a battery revert option (X30 or X43),*** first turn the power On/Off switch to On (1), then reconnect the batteries.

Post-Replacement Optimization Procedure

Perform the *Station Power Output Alignment* procedure in Section 14 – *Station Alignment*. If the station has an External Circulator (Option X676 or Option X677), perform the *External Wattmeter Calibration* procedure, also in Section 14 – *Station Alignment*.

High Power Amplifier Module

High Power Amplifier Modules are rated at 300 W or greater.

Replacement Procedure

Step 1. Connect static wrist strap connector into receptacle located on either side of station chassis.

Step 2. Turn off station power using Power Supply Module On/Off (0/1) switch (on both power supply modules). ***If the station has ac power with a battery revert option (X30 or X43),*** first disconnect the batteries, then turn the power On/Off switches to Off (0).

Step 3. Remove four mounting screws securing Power Amplifier module to cabinet side rails.

Step 4. Slide the module partially out of the chassis. Disconnect the N-type connector (rf output from the module) from the right side of module.

Step 5. Remove faulty module from cage.

Step 6. Install replacement Power Amplifier Module by sliding module partially into cage (module about 3 inches from full insertion). Connect the rf output cable to the N-type connector at the right side of the module.

Step 7. Slide the module in completely and firmly seat the module connector into the Backplane. ***Do not force the module into the Backplane connectors. Several connectors must be seated simultaneously. Use moderate pressure and rock the module slightly until it is completely seated.***

Step 8. Secure module with four mounting screws removed in Step 3.

Step 9. Restore power to the station using both Power Supply Module On/Off (0/1) switches. ***If the station has ac power with a battery revert option (X30 or X43),*** first turn the power On/Off switches to On (1), then reconnect the batteries. Refer to **CAUTION** at left.

CAUTION

When restoring power to the station, be sure to turn on both power supplies.

Post-Replacement Optimization Procedure

Perform the *Station Power Output Alignment* procedure in Section 14 – *Station Alignment*. If the station has an External Circulator (Option X676 or Option X677), perform the *External Wattmeter Calibration* procedure, also in Section 14 – *Station Alignment*.

Power Supply Module

Replacement Procedure

Step 1. Connect static wrist strap connector into receptacle located on either side of station chassis.

Step 2. Turn off station power using Power Supply Module On/Off switch(es). ***If the station has ac power with a battery revert option (X30 or X43),*** first disconnect the batteries, then turn the power On/Off switch(es) to Off (0).

Step 3. Remove front-panel mounting screws from top and bottom of module front panel.

Step 4. Remove faulty Power Supply Module from cage.

Step 5. Install replacement Power Supply Module by sliding module into cage, firmly seating the module connector into the Backplane. ***Do not slam the module against the Backplane or push any harder than necessary to seat the connectors.***

Step 6. Secure module with two mounting screws removed in Step 3.

Step 7. Restore power to the station using Power Supply Module On/Off switch(es). ***If the station has ac power with a battery revert option (X30 or X43),*** first turn the power On/Off switch(es) to On (1), then reconnect the batteries.

Post-Replacement Optimization Procedure

Replacement Power Supply Modules are factory-aligned. Therefore, no post-replacement optimization is required for this module.

Exciter Module and Station Control Board

CAUTION

The Exciter Module and Station Control Board are aligned together in the factory as a matched pair and must be installed into the same station at the same time.

The Exciter Module and Station Control Board (SCB) are aligned in the factory together as a matched pair and are assigned a common Alignment ID number. If they are not installed together, the Control Front Panel will receive an **ALIGNMENT ID MISMATCHED** alarm upon station start-up or reset. Refer to **CAUTION** at left. (The Alignment IDs can be checked on the Station Status menu under **SOFTWARE VERSIONS**.)

Configuration Settings

The SIMM on the Station Control Board (SCB) shipped from the factory contains default settings for customer-specific parameters such as channel frequency and output power. Before replacing the SCB, log the current configuration settings of the station in order to reconfigure the new SCB after installation.

For menu items with an asterisk (*), circle the current setting for that item in the list that follows. For items with a numeric value, write the current value in the space to the right of the item in the list.

STN – STATION

- SYS TIMER ALRM *
  - DISABLE
  - 2 MIN
  - 15 MIN
  - 30 MIN
  - 60 MIN
  - 90 MIN
  - 120 MIN
  - 180 MIN
- FRONT PANEL PASSWORD *
  - ENABLED
  - DISABLED
- PASSWORD (DEFAULT = 6000) _____

RX – RECEIVER

- RX CHN FREQ 152.84 _____
- CHNSPACING *
  - 12.5 KHZ
  - 20 KHZ
  - 25 KHZ
- RX DEEMPHASIS *
  - ENABLED
  - DISABLED
- RX OUTPUT *
  - INVERTED
  - NOT INVERTED
- MONITOR RX OUTPUT *
  - ANALOG
  - TTL

OPT 1 – STATION OPTIONS

- ANTENNA RELAY *
  - DISABLED
  - ENABLED
- EXT CIRCULATOR *
  - NOT PRESENT
  - PRESENT
- CHN MAPPED PWR *
  - DISABLED
  - ENABLED

ASET – ALARM SETUP

- FWD PWR ALM PT _____
- RFL PWR ALM PT _____
- EXT WM FWD PWR ALM PT _____
- EXT WM RFL PWR ALM PT _____

DIS – ACCESS DISABLE

- MAINT ACCESS *
  - DISABLED
  - ENABLED
- PAGING ACCESS *
  - DISABLED
  - ENABLED

CNFG – STATION CONFIGURATION

- BATTERY REVERT SETUP
  - BATTERY TYPE *
    - VENTED LEAD CALCIUM
    - SEALED LEAD CALCIUM
    - NICAD
    - GENERIC
    - BATTERY REVERT DISABLED
  - CHARGING *
    - ENABLED
    - DISABLED
  - BACKUP *
    - BACKUP STATION
    - BACKUP CONTROL
  - FIXED CUTBK RED % 50 _____
- EXT WATTMETER TYPE *
  - NONE
  - CLASS 1 EXT
  - CLASS 2 EXT
  - CLASS 3 EXT
  - CLASS 4 EXT
- CONTROL *
  - INTERNAL CNET
  - EXTERNAL SYNCH LOCAL CTRL
- RX TYPE *
  - NO INTERNAL
  - INTERNAL LINK
  - INTERNAL MONITOR
- SPECIAL KEY SELECT *
  - NONE
  - CD INT
  - CD EXT
  - SPCL KEY
  - FAST LOW
  - FAST HIGH
  - EXT LOW
  - EXT HIGH

* (Circle one of the following)

Exciter Module and Station Control Board (cont'd)

TX – TRANSMIT

TX CHN FREQS

CHN 1 FREQ _____
CHN 2 FREQ _____
CHN 3 FREQ _____
CHN 4 FREQ _____
CHN 5 FREQ _____
CHN 6 FREQ _____
CHN 7 FREQ _____
CHN 8 FREQ _____
CHN 9 FREQ _____
CHN 10 FREQ _____
CHN 11 FREQ _____
CHN 12 FREQ _____
CHN 13 FREQ _____
CHN 14 FREQ _____
CHN 15 FREQ _____
CHN 16 FREQ _____
CHN 17 FREQ _____
CHN 18 FREQ _____
CHN 19 FREQ _____
CHN 20 FREQ _____
CHN 21 FREQ _____
CHN 22 FREQ _____
CHN 23 FREQ _____
CHN 24 FREQ _____
CHN 25 FREQ _____
CHN 26 FREQ _____
CHN 27 FREQ _____
CHN 28 FREQ _____
CHN 29 FREQ _____
CHN 30 FREQ _____
CHN 31 FREQ _____
CHN 32 FREQ _____

TX – TRANSMIT *(continued)*

TX CHN PWR *(if CHN MAPPED PWR disabled)*

OPERATING PWR _____

TX CHN PWR *(if CHN MAPPED PWR enabled)*

CHN 1 PWR _____
CHN 2 PWR _____
CHN 3 PWR _____
CHN 4 PWR _____
CHN 5 PWR _____
CHN 6 PWR _____
CHN 7 PWR _____
CHN 8 PWR _____
CHN 9 PWR _____
CHN 10 PWR _____
CHN 11 PWR _____
CHN 12 PWR _____
CHN 13 PWR _____
CHN 14 PWR _____
CHN 15 PWR _____
CHN 16 PWR _____
CHN 17 PWR _____
CHN 18 PWR _____
CHN 19 PWR _____
CHN 20 PWR _____
CHN 21 PWR _____
CHN 22 PWR _____
CHN 23 PWR _____
CHN 24 PWR _____
CHN 25 PWR _____
CHN 26 PWR _____
CHN 27 PWR _____
CHN 28 PWR _____
CHN 29 PWR _____
CHN 30 PWR _____
CHN 31 PWR _____
CHN 32 PWR _____
MEAN FREQ PWR _____

TX CHN OFFSETS

HIGH SPEED OFFSET _____
LOW SPEED OFFSET _____

LOW SPEED SPLATTER FILTER *

88 US LOW PASS
140 US LOW PASS
250 US LOW PASS

NOMINAL BINARY DEVIATION _____

SPECIAL TX SETUP

TX DATA INVERT *

ENABLED
DISABLED

TX = RX *

ENABLED
DISABLED

IDLE DEVIATION *

NULL
SPACE
MARK

* (Circle one of the following)

Exciter Module and Station Control Board (cont'd)

Exciter Module/SCB Replacement Procedure

Exciter Module

Step 1. Connect static wrist strap connector into receptacle located on either side of station chassis.

Step 2. Turn off station power using Power Supply Module On/Off switch(es). ***If the station has ac power with a battery revert option (X30 or X43),*** first disconnect the batteries, then turn the power On/Off switch(es) to Off (0).

Step 3. Remove front-panel mounting screws from top and bottom of Exciter Module front panel.

Step 4. Disconnect mini-UHF connector on rf cable connecting Power Amplifier Module to Exciter Module.

Step 5. Remove old Exciter Module from station chassis.

Step 6. Install replacement Exciter Module by sliding module into cage, firmly seating module connector into the Backplane. ***Do not force module into the mating Backplane connector. Use moderate pressure until the module is completely seated.*** Now reconnect the rf cable from the Power Amplifier Module.

Step 7. Secure module with two mounting screws removed in Step 3.

Station Control Board (SCB)

Step 8. The Station Control Board (SCB) is part of the Station Control Module. Remove mounting screws from top and bottom of Control front panel. Pull Control front panel outward until ribbon cable connector is accessible.

Step 9. Disconnect ribbon cable connector from the SCB and set aside Control front panel.

Step 10. Remove old SCB (on ***left side*** in cavity behind Control front panel) by pulling straight outward.

Step 11. Disengage Control/Receiver Interface Board (CRIB) standoffs from back of old SCB by pressing the two tabs together. Once all four standoffs are free, carefully remove CRIB from old SCB. Insert CRIB into replacement SCB, making sure that connectors are properly aligned. Firmly seat CRIB until the four standoffs are fully engaged.

Step 12. Install replacement SCB by sliding board into chassis, firmly seating board card-edge connectors into Backplane. ***Do not force board into mating Backplane connector. Use moderate pressure and rock board slightly until it is completely seated.***

Step 13. Reconnect ribbon cable from the rear of Control front panel to the SCB.

Step 14. Replace Control front panel and secure with mounting screws removed in Step 8.

Step 15. Restore power to the station using the Power Supply Module On/Off switch(es). ***If the station has ac power with a battery revert option (X30 or X43),*** first turn the power On/Off switch(es) to On (1), then reconnect the batteries.

Exciter Module and Station Control Board (cont'd)

Post-Replacement Optimization Procedure

Step 1. Perform the *Configuration Procedure* in Section 12 – *Station Configuration*. Use the configuration settings you logged in this procedure to restore the station to its previous configuration.

Step 2. Perform the *Calibrating Station Reference Oscillator* procedure in Section 17 – *Routine Maintenance*.

Step 3. Perform the alignment procedures in Section 14 – *Station Alignment*.

Step 4. Make sure there is no **ALIGNMENT ID MISMATCHED** alarm on the Alarms menu.

Control/Receiver Interface Board (CRIB)

The Control/Receiver Interface Board (CRIB) is required when an internal receiver (Receiver Module) is present. It produces the receiver audio output, and gates the output onto the station Backplane.

Replacement Procedure

Step 1. Connect static wrist strap connector into receptacle located on either side of station chassis.

Step 2. Turn off station power using Power Supply Module On/Off switch(es). ***If the station has ac power with a battery revert option (X30 or X43),*** first disconnect the batteries, then turn the power On/Off switch(es) to Off (0).

Step 3. Remove mounting screws from top and bottom of Control front panel. Pull Control front panel outward until ribbon cable connector is accessible.

Step 4. Disconnect ribbon cable connector from rear of Control front panel and set aside Control front panel.

Step 5. Remove Station Control Board (SCB) (on ***left side*** in cavity behind Control front panel) by pulling straight outward.

Step 6. Disengage CRIB standoffs from back of SCB by pressing the two tabs together. Once all four standoffs are free, carefully remove CRIB from SCB. Insert replacement CRIB into SCB, making sure that connector P11 is properly aligned. Firmly seat CRIB until the four standoffs are fully engaged.

Step 7. Replace SCB by sliding it into cage, firmly seating board card-edge connectors into Backplane. ***Do not force board into mating Backplane connector. Use moderate pressure and rock board slightly until it is completely seated.***

Step 8. Reconnect ribbon cable from SCB to rear of front panel.

Step 9. Replace Control front panel and secure with mounting screws removed in Step 3.

Step 10. Restore power to the station using Power Supply Module On/Off switch(es). ***If the station has ac power with a battery revert option (X30 or X43),*** first turn the power On/Off switch(es) to On (1), then reconnect the batteries.

Internal NIU Board

Replacement Procedure

Step 1. Connect static wrist strap connector into receptacle located on either side of station chassis.

Step 2. Turn off station power using Power Supply Module On/Off switch(es). ***If the station has ac power with a battery revert option (X30 or X43),*** first disconnect the batteries, then turn the power On/Off switch(es) to Off (0).

Step 3. Remove mounting screws from top and bottom of Control front panel. Pull Control front panel outward until ribbon cable connector is accessible.

Step 4. Disconnect ribbon cable connector from rear of Control front panel and set aside Control front panel.

Step 5. Remove NIU board (on ***right side*** in cavity behind Control front panel) by pulling straight outward.

Step 6. If an Option X437 Dial Modem or an Option X443 Link Modem is installed on the NIU board, remove the modem(s) and install on the new NIU board. (See the installation procedures that follow this procedure.)

Step 7. Set all switches on replacement NIU board to match those on the faulty board. Refer to Section 13 – *Internal NIU Configuration* for further details.

Step 8. Install replacement NIU board by sliding board into cage, firmly seating the board card-edge connectors into the Backplane. ***Do not force the board into the mating Backplane connector. Use moderate pressure and rock the board slightly until it is completely seated.***

Step 9. Reconnect ribbon cable from SCB to rear of Control front panel.

Step 10. Replace Control front panel and secure with two mounting screws removed in Step 3.

Step 11. Restore power to the station using Power Supply Module On/Off switch(es). ***If the station has ac power with a battery revert option (X30 or X43),*** first turn the power On/Off switch(es) to On (1), then reconnect the batteries.

Post-Replacement Optimization Procedure

No post-replacement procedures are required for the Internal NIU Board.

Dial Modem

NOTE: *Option X437 adds a factory-installed Dial Modem to the NIU board. To order a Dial Modem for field-installation, order kit number TRN7993.*

CAUTION

When installing modem cards on NIU board, ensure cards are straight in socket and contact fingers are touching edge contacts before locking with retainer clips.

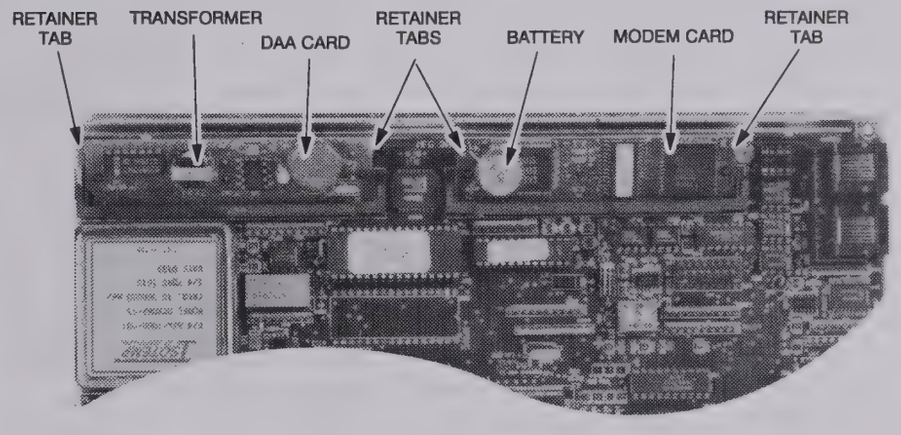
The Dial Modem consists of two SIMM-type circuit cards which are installed in SIMM sockets located at the top of the NIU board. The line driver (DAA) card is installed in the left SIMM socket and can be identified by the installed transformer. The modem card is installed in the right SIMM socket and can be identified by the installed button-type battery.

Installation Procedure

Step 1. If required, remove the NIU board from the station and place on a clean work surface.

Step 2. Insert the contact side of the DAA card into the SIMM socket above the oscillator housing. (Refer to **CAUTION** notice at left.) The card is keyed so that it can be inserted only one way. Press card contacts into socket, then carefully press downward on DAA card (toward board) until retainer tabs engage on both sides.

Step 3. Repeat Step 2 for the modem card, installing it in the SIMM socket closest to the rear edge of the board (closest to Backplane connectors). Ensure card is fully seated and retainer tabs are engaged.



Step 4. Reinstall NIU board in *Nucleus* Paging Station cage.

Link Modem

NOTE: *Option X443 adds a factory-installed Link Modem to the NIU board. To order a Link Modem for field-installation, order kit number TRN7994.*

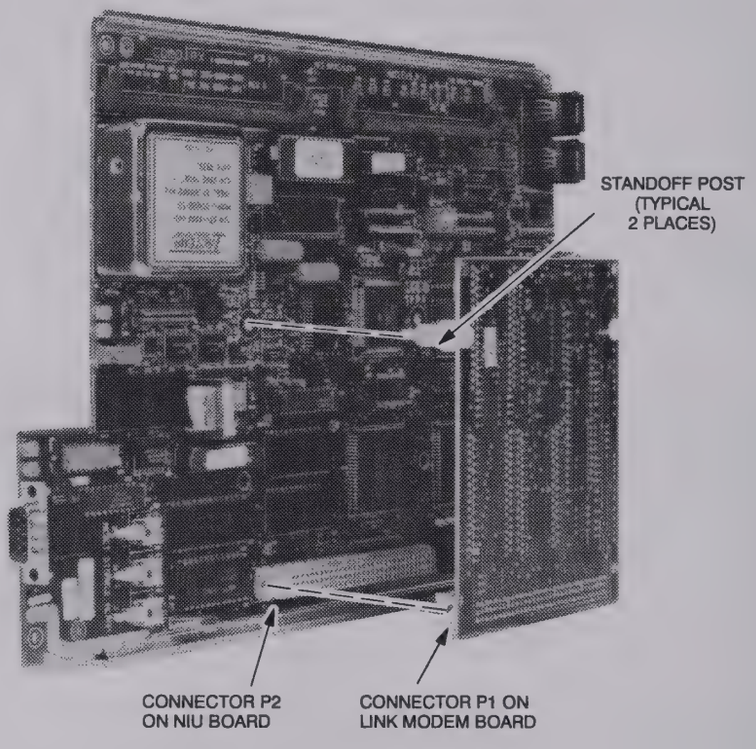
The Link Modem (QAM) is in the form of a daughter board mounted on the NIU board.

Installation Procedure

Step 1. If required, remove the NIU board from the station and place on a clean work surface.

Step 2. Remove the nylon nuts from both standoff posts on the link modem card.

Step 3. Install the link modem card so that connector P1 on the link modem mates with connector P2 on the NIU board and the standoff posts pass through the holes on the NIU board.



Step 4. Secure modem to board with two nylon nuts on standoff posts.

Step 5. Reinstall NIU board in *Nucleus* Paging Station cage.

Wildcard Interface Board

Replacement Procedure

Step 1. Connect static wrist strap connector into receptacle located on either side of station chassis.

Step 2. Turn off station power using Power Supply Module On/Off switch(es). ***If the station has ac power with a battery revert option (X30 or X43),*** first disconnect the batteries, then turn the power On/Off switch(es) to Off (0).

Step 3. Remove mounting screws from top and bottom of Control front panel. Pull Control front panel outward until ribbon cable connector is accessible.

Step 4. Disconnect ribbon cable connector from rear of Control front panel and set aside Control front panel.

Step 5. Remove Wildcard Interface Board (on ***right side*** in cavity behind Control front panel) by pulling straight outward.

Step 6. Set all jumpers on replacement board to match those on the faulty board. These include input/output impedance matching jumpers, 2-wire/4-wire select jumper, and dc remote control selection jumpers.

Step 7. Install replacement Wildcard Interface Board by sliding board into cage, firmly seating the board card-edge connectors into the Backplane. ***Do not force the board into the mating Backplane connector. Use moderate pressure and rock the board slightly until it is completely seated.***

Step 8. Reconnect ribbon cable from SCB to rear of Control front panel.

Step 9. Replace Control front panel and secure with two mounting screws removed in Step 3.

Step 10. Restore power to the station using Power Supply Module On/Off switch(es). ***If the station has ac power with a battery revert option (X30 or X43),*** first turn the power On/Off switch(es) to On (1), then reconnect the batteries.

Post-Replacement Optimization Procedure

No post-replacement procedures are required for the Wildcard Interface Board.

Reference Module

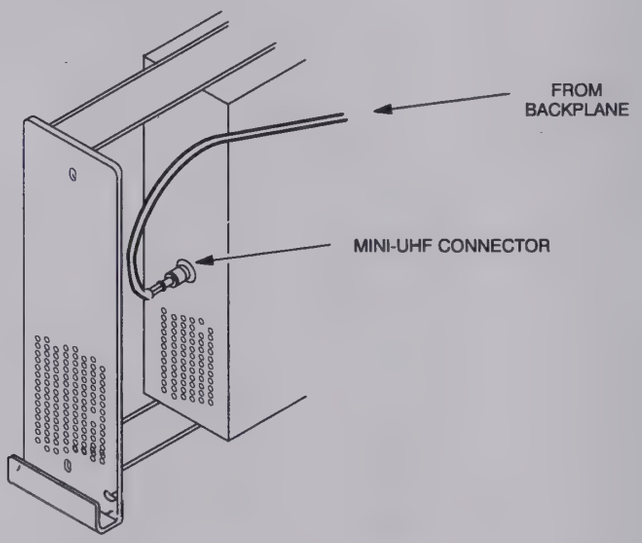
Replacement Procedure

Step 1. Connect static wrist strap connector into receptacle located on either side of station chassis.

Step 2. Turn off station power using Power Supply Module On/Off switch(es). ***If the station has ac power with a battery revert option (X30 or X43),*** first disconnect the batteries, then turn the power On/Off switch(es) to Off (0).

Step 3. Remove front-panel mounting screws from top and bottom of module front panel.

Step 4. Slide the module partially out of the cage. If the module includes a GPS receiver, disconnect the mini-UHF connector on the inside front surface of the module (behind the front panel) as shown below.



Step 5. Remove faulty Reference Module from cage.

Step 6. Install replacement Reference Module, sliding module partially into cage. Connect mini-UHF connector (if the module includes a GPS receiver), then push the module all the way into cage, firmly seating the module connector into the Backplane. ***Do not slam the module against the Backplane or push any harder than necessary to seat the connectors.***

Step 7. Secure module with two mounting screws removed in Step 3.

Step 8. Restore power to the station using Power Supply Module On/Off switch(es). ***If the station has ac power with a battery revert option (X30 or X43),*** first turn the power On/Off switch(es) to On (1), then reconnect the batteries.

Post-Replacement Optimization Procedure

If the Reference Module includes a UHSO or HSO, perform the *Calibrating UHSO or HSO in Reference Module* procedure in Section 17 – *Routine Maintenance*.

900 MHz Receiver Module

NOTE: *The Control/Receiver Interface Board (CRIB) is not inside the Receiver Module housing; instead, it is attached to the Station Control Board (SCB) inside the Control Module housing. See separate CRIB replacement procedure following the Exciter Module/SCB replacement procedure.*

Replacement Procedure

Step 1. Connect static wrist strap connector into receptacle located on either side of station chassis.

Step 2. Turn off station power using Power Supply Module On/Off switch(es). ***If the station has ac power with a battery revert option (X30 or X43),*** first disconnect the batteries, then turn the power On/Off switch(es) to Off (0).

Step 3. Remove front-panel mounting screws from top and bottom of module front panel.

Step 4. Disconnect mini-UHF connector on rf cable connecting Receiver Module to the antenna.

Step 5. Remove faulty module from cage.

Step 6. Install replacement Receiver Module by sliding module into cage. Route the rf cable connecting the Receiver Module to the antenna in the slot on top of the module housing. Firmly seat the module connector into the Backplane. ***Be sure to replace the module in the correct Backplane connector: the second from the right side of the station cage.*** (***Do not*** slam the module against the Backplane or push any harder than necessary to seat the connectors.) Now reconnect the rf cable from the antenna.

Step 7. Secure module with two mounting screws removed in Step 3.

Step 8. Restore power to the station using Power Supply Module On/Off switch(es). ***If the station has ac power with a battery revert option (X30 or X43),*** first turn the power On/Off switch(es) to On (1), then reconnect the batteries.

Post-Replacement Optimization Procedure

No post-replacement procedures are required for the 900 MHz Receiver Module.

VHF and UHF Receiver Modules

VHF and UHF Receiver Modules consist of a Preselector Assembly and a Receiver Board attached to the module housing. The Preselector Assembly and the Receiver Board are each considered to be a Field Replaceable Unit (FRU). Replacement procedures are given for each FRU. If you choose to replace the entire module (including receiver board and preselector), you must perform the preselector tuning procedure that follows.

Replacement Procedure

Step 1. Connect static wrist strap connector into receptacle located on either side of station chassis.

Step 2. Turn off station power using Power Supply Module On/Off switch(es). ***If the station has ac power with a battery revert option (X30 or X43),*** first disconnect the batteries, then turn the power On/Off switch(es) to Off (0).

Step 3. Remove anti-vibration screws from top and bottom of module front panel.

Step 4. Slide the module out just far enough to disconnect the mini-UHF connector on the rf cable (rf input to the module) connected to the preselector assembly.

Step 5. If **Receiver Board** is being replaced:

— Disconnect cable (mini-UHF connector) connected to Receiver Board.

— Remove nine (9) *TORX*-head screws that secure Receiver Board to module housing. Note location of foam insulating pad beneath VCO portion of Receiver Board.

— Remove faulty board and replace with known good board. Be sure to position the foam insulating pad (noted in previous step) behind the VCO.

— Secure board using *TORX*-head screws removed previously. Reconnect rf cable to mini-UHF connector on board.

Step 6. If **Preselector Assembly** is being replaced:

— Disconnect cables (mini-UHF connectors) from assembly.

— Remove faulty Preselector Assembly by removing two (2) *TORX*-head screws securing assembly to module housing.

— Install known good assembly and secure using *TORX*-head screws removed previously. Reconnect rf cables to mini-UHF connectors.

VHF and UHF Receiver Modules (cont'd)

Step 7. Install replacement Receiver Module by sliding module into cage. Push the module until about 2 inches remains out of the housing. Connect the rf input cable to the mini-UHF connector on the Preselector Assembly.

Step 8. Slide the module in completely and firmly seat the module connector into the backplane. ***(Do not slam the module against the backplane or push any harder than necessary to seat the connectors.)*** Secure with the two anti-vibration screws in the top and bottom of the module.

Step 9. Restore power to the station using the Power Supply Module On/Off switch(es). ***If the station has ac power with a battery revert option (X30 or X43),*** first turn the power On/Off switch(es) to On (1), then reconnect the batteries.

Post-Replacement Optimization Procedure

Step 1. If you replaced the **Preselector Assembly**, perform the preselector field tuning procedure that follows.

VHF/UHF Receiver Module Preselector Field Tuning

IMPORTANT

Tuning for best SINAD response ***does not*** result in optimum tuning of the preselector assembly. You must use this field tuning procedure to obtain optimum preselector performance.

The preselector assembly is a 5-pole (VHF) or 3-pole (UHF) bandpass filter equipped with tuning slugs to adjust the passband corresponding to the operating frequency(s) of the receiver. The preselector assembly must be field-tuned if replaced in the field or if the receiver operating frequency(s) are modified. The tuning procedure follows.

Required Test Equipment

The following test equipment is required to properly tune the preselector assembly:

- RF Signal Generator — Motorola R2600 Communications Analyzer, R2001 Communications Analyzer, or HP8657A signal generator (or equivalent). (The R2600 Communications Analyzer can both generate and measure simultaneously. The R2001 may be used for either the generator or the monitor function, but not both simultaneously. When using R2001 as the signal generator, rf signal **must** be taken from the Antenna port.)
- Dip/Peak Monitor — HP435B Power Meter (or equivalent) with HP8484A sensitive power head, Boonton Model 92E with BNC input, or R2001/R2600 using the spectrum analyzer function.
- Torque driver capable of delivering 12 inch-pounds of torque and 10 mm deep well socket.
- Tuning probe — Motorola Part No. 0180763D22, part of TRN7799A tuning kit.
- Flat-blade screwdriver.

VHF/UHF Receiver Module Preselector Field Tuning (cont'd)

VHF Preselector:

Calculating Proper Alignment Frequency

Use one of the following two methods to calculate the alignment frequency to be generated by the signal generator.

For receivers with a **single receive frequency**, calculate the frequency of the alignment signal as follows:

Step 1. Determine the receiver receive frequency.

Step 2. If Receiver Module is VHF 132–154 MHz, and the frequency is $\leq$ 148 MHz , subtract 250 kHz.

If Receiver Module is VHF 150–174 MHz, and the frequency is $\leq$ 156 MHz, subtract 250 kHz.

Otherwise, note actual frequency.

Example: If receive frequency is 134.575 MHz, subtract 250 kHz, since frequency is less than 148 MHz.

134.575 MHz — 250 kHz = 134.325 MHz

Step 3. If Receiver Module is VHF 132–154 MHz, determine the alignment frequency as follows:

If frequency (from Step 2) is < 134 MHz, then alignment frequency = 133.75 MHz.

If frequency (from Step 2) is > 152 MHz, then alignment frequency = 152 MHz.

Otherwise, use the frequency determined in Step 2.

Step 4. If Receiver Module is VHF 150–174 MHz, determine the alignment frequency as follows:

If frequency (from Step 2) is < 152 MHz, then alignment frequency = 151.75 MHz.

If frequency (from Step 2) is > 172 MHz, then alignment frequency = 172 MHz.

Otherwise, use the frequency determined in Step 2.

For receivers with **multiple receive frequencies**, calculate the frequency of the alignment signal as follows:

Step 1. Note the receive frequency for each channel supported by the receiver.

Step 2. Calculate a midpoint frequency as follows:

$$F_{mid} = (F_{highest} + F_{lowest}) \div 2$$

Step 3. Using F_{mid} in place of the receiver receive frequency, perform Step 2 thru Step 4 from above.

VHF/UHF Receiver Module Preselector Field Tuning (cont'd)

VHF Preselector:

Preparing Equipment

Step 1. Make sure Receiver Module (with Preselector Assembly) is installed in a functional station cage equipped with a Power Supply Module.

Step 2. Remove the two *TORX*-head screws from the Receiver Module front panel and remove the panel.

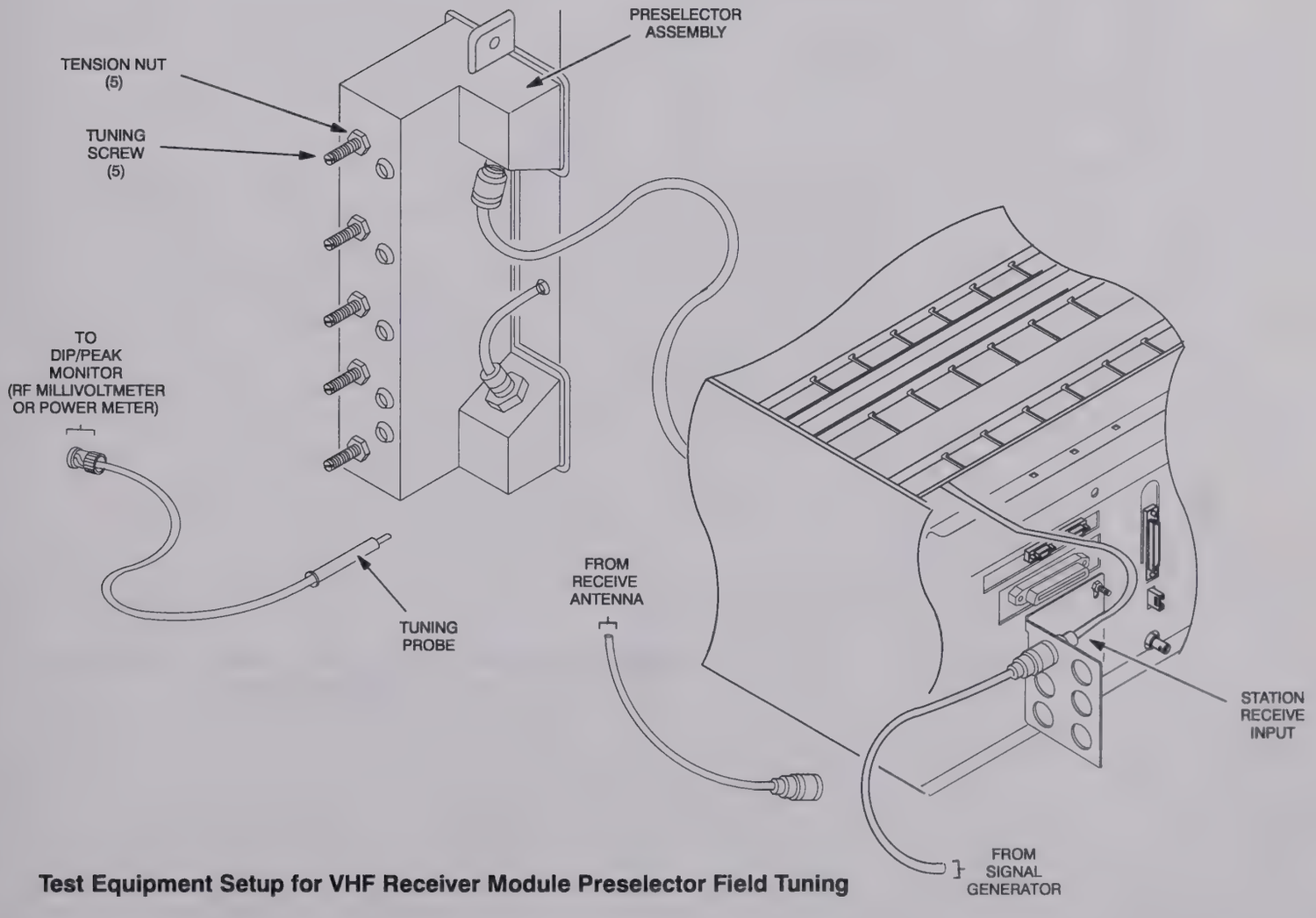
Step 3. Detune the preselector as follows:

If the alignment frequency (calculated on the previous page) is > 148 MHz (if Receiver Module is VHF 132–154 MHz), or 156 MHz (if Receiver Module is VHF 150–174 MHz), turn the five tuning screws in (CW) until 1/8 inch protrudes past each of the tension nuts.

If the alignment frequency is ≤ 148 MHz (if Receiver Module is VHF 132–154 MHz), or 156 MHz (if Receiver Module is VHF 150–174 MHz), back out (CCW) the five tuning screws until 3/4 inch protrudes past each of the tension nuts.

Step 4. Using the torque driver and deep well socket, tighten the five tension nuts on the adjustment screws to 6 inch-pounds.

Step 5. Connect the test equipment as shown below:



Test Equipment Setup for VHF Receiver Module Preselector Field Tuning

VHF/UHF Receiver Module Preselector Field Tuning (cont'd)

IMPORTANT

When tuning for peak or dip, turn the tuning screw 1/2 turn past the peak or dip to verify that you have obtained a true peak or dip. After ensuring you have found true peak or dip, turn the screw back to the location of the original peak or dip.

VHF Preselector:

Tuning Procedure

Step 1. Turn the station power supply ON (to provide the active 50-Ω termination).

Step 2. Adjust the signal generator to the alignment frequency calculated previously. Set the level to +5 dBm.

Step 3. Insert tuning probe into cavity H1 and adjust tuning screw 1 for a **PEAK**.

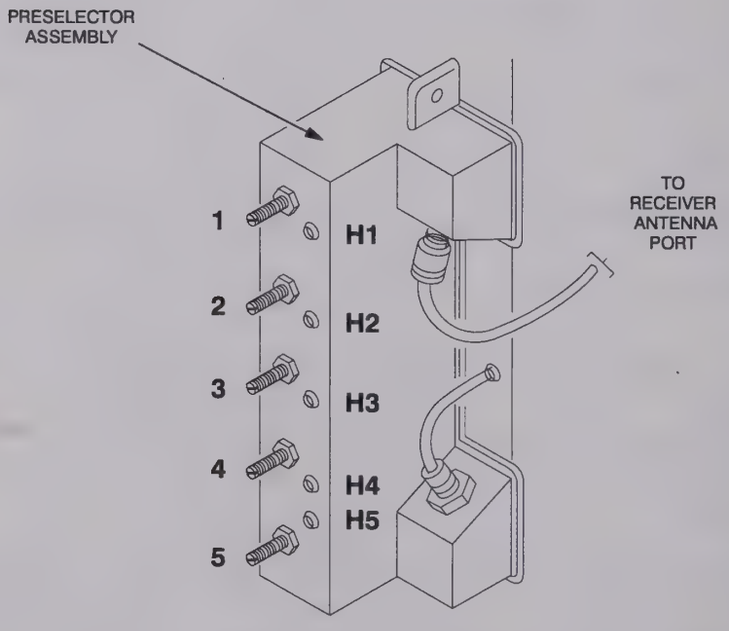
Step 4. Leave tuning probe in cavity H1 and adjust tuning screw 2 for a **DIP**.

Step 5. Insert tuning probe into cavity H2 and adjust tuning screw 3 for a **DIP**.

Step 6. Insert tuning probe into cavity H3 and adjust tuning screw 4 for a **DIP**.

Step 7. Insert tuning probe into cavity H4. Decrease output from signal generator to −5 dBm.

Step 8. Adjust tuning screw 5 for a **DIP**. Then turn tuning screw 5 1/4 turn CCW. (Note that dip will not be as sharp for screw 5 as it was for screws 2 thru 4.)



Location of VHF Receiver Module Preselector Tuning Screws and Cavity Probe Holes

VHF/UHF Receiver Module Preselector Field Tuning (cont'd)

UHF Preselector:

Calculating Proper Alignment Frequency

Use one of the following two methods to calculate the alignment frequency to be generated by the signal generator.

For receivers with a **single receive frequency**, calculate the frequency of the alignment signal as follows:

Step 1. Determine the receiver receive frequency. Add 200 kHz.

Step 2. If Receiver Module is a UHF 403–433 MHz receiver, determine the alignment frequency as follows:

If frequency (from Step 1) is > 431 MHz, then alignment frequency = 431 MHz.

If frequency (from Step 1) is < 405 MHz, then alignment frequency = 405 MHz.

Otherwise, use the frequency determined in Step 1.

Step 3. If Receiver Module is a UHF 438–470 MHz receiver, determine the alignment frequency as follows:

If frequency (from Step 1) is > 468 MHz, then alignment frequency = 468 MHz.

If frequency (from Step 1) is < 440 MHz, then alignment frequency = 440 MHz.

Otherwise, use the frequency determined in Step 1.

Step 4. If Receiver Module is a UHF 470–496 MHz or 496–520 MHz receiver, determine the alignment frequency as follows:

If frequency (from Step 1) is > 518 MHz, then alignment frequency = 518 MHz.

If frequency (from Step 1) is < 472 MHz, then alignment frequency = 472 MHz.

Otherwise, use the frequency determined in Step 1.

For receivers with **multiple receive frequencies**, calculate the frequency of the alignment signal as follows:

Step 1. Note the receive frequency for each channel supported by the receiver.

Step 2. Calculate a midpoint frequency as follows:

$$F_{mid} = (F_{highest} + F_{lowest}) \div 2$$

Step 3. Using F_{mid} in place of the receiver receive frequency, perform Step 1 thru Step 4 from above.

VHF/UHF Receiver Module Preselector Field Tuning (cont'd)

UHF Preselector:

Preparing Equipment

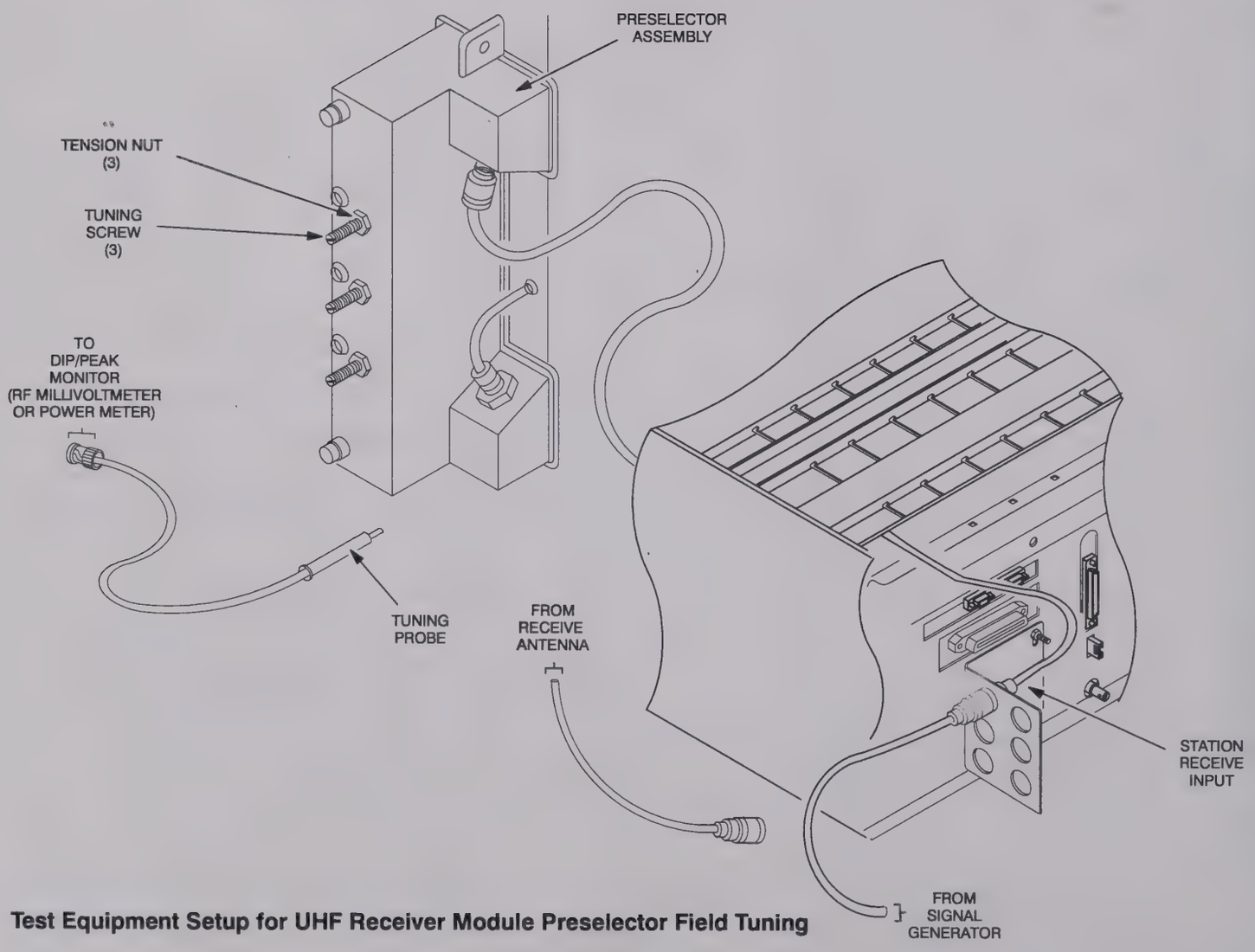
Step 1. Make sure Receiver Module (with Preselector Assembly) is installed in a functional station cage equipped with a Power Supply Module.

Step 2. Remove the two *TORX*-head screws from the Receiver Module front panel and remove the panel.

Step 3. Using the torque driver and deep well socket, loosen the three tension nuts on the adjustment screws.

Step 4. Detune the preselector as follows.
Turn tuning screws **3** and **4** clockwise until they bottom out. Be careful not to apply more than 3 inch-pounds of torque to prevent warping preselector cover and housing.

Step 5. Connect the test equipment as shown below:



Test Equipment Setup for UHF Receiver Module Preselector Field Tuning

VHF/UHF Receiver Module Preselector Field Tuning (cont'd)

IMPORTANT

When tuning for peak or dip, turn the tuning screw 1/2 turn past the peak or dip to verify that you have obtained a true peak or dip. After ensuring you have found true peak or dip, turn the screw back to the location of the original peak or dip.

UHF Preselector:

Tuning Procedure

Step 1. Turn the station power supply ON (to provide the active 50-Ω termination).

Step 2. Adjust the signal generator to the alignment frequency calculated previously. Set the level to +5 dBm.

Step 3. Insert tuning probe into cavity U2 and adjust tuning screw 2 for a **PEAK**.

Step 4. Tighten tension nut on tuning screw 2 to at least 12 inch-pounds and fine tune tuning screw 2 for a **PEAK**.

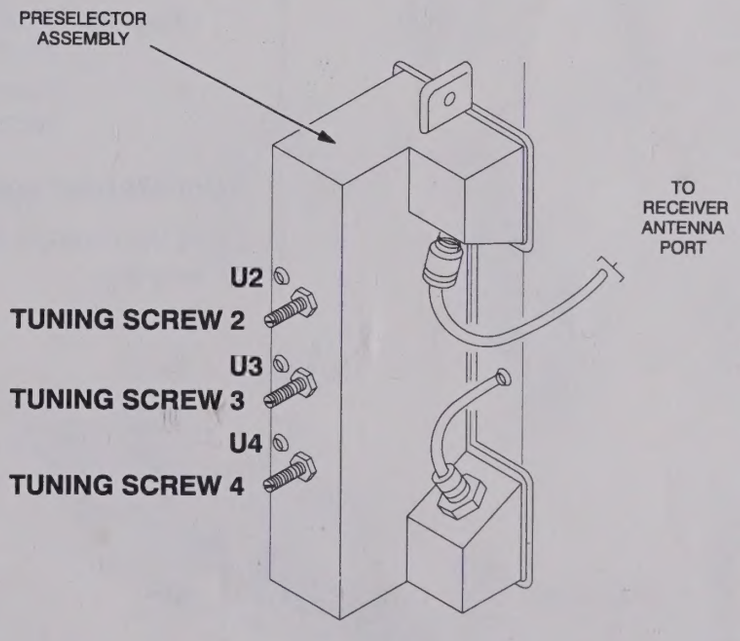
Step 5. Keep tuning probe in cavity U2 and adjust tuning screw 3 for a **DIP**.

Step 6. Tighten tension nut on tuning screw 3 to at least 12 inch-pounds and fine tune tuning screw 2 for a **DIP**.

Step 7. Insert tuning probe into cavity U3. Decrease output from signal generator to −5 dBm.

Step 8. Adjust tuning screw 4 for a **DIP**.

Step 9. Tighten tension nut on tuning screw 4 to at least 12 inch-pounds and fine tune tuning screw 4 for a **DIP**.



Location of UHF Receiver Module Preselector Tuning Screws and Cavity Probe Holes

Backplane Board

Replacement Procedure

Step 1. Connect static wrist strap connector into receptacle located on either side of station chassis.

Step 2. Turn off station power using Power Supply Module On/Off switch(es).

Step 3. Remove all modules and boards from the station cage as described in this section. Ensure that all modules and boards are placed in anti-static bags or on properly grounded anti-static surfaces.

Step 4. Label all cables connected to the rear of the Backplane board. Disconnect all cables from the Backplane.

Step 5. Remove the 11 *TORX*-head screws securing the rear metal shield and Backplane board to the cage.

Step 6. Remove the metal shield and Backplane board, sliding the two guide pins located at each end on the bottom of the metal shield from the Back ane board.

Step 7. Remove the Backplane boa rom the cage.

Step 8. Install the replacement Backplane board and rear metal shield using the 11 *TORX*-head screws re oved in Step 5.

Step 9. Reconnect all cables to the rear of the Bac plane and reinstall all modules and boards removed in Step 3.

Step 10. Restore power to the station using Powe Supply Module On/Off switch(es). ***If the station has ac po ver with a battery revert option (X30 or X43),*** first turn the power On/Off switch(es) to On (1), then reconnect the batteries.

Post-Replacement Optimization Procedure

Using the front-panel keypad, check that all parameters and functions are set properly.

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